ON FREE-RIDERS AND SOVEREIGN DEFAULT: THE RISE OF NON-TRADITIONAL BILATERAL LENDERS AND THE RESULTING CHALLENGES TO INTERNATIONAL DEBT RENEGOTIATIONS

By

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Abstract: Since the onset of the Global Financial Crisis in 2007, new cross-border lending to emerging and developing countries has been dominated by 'non-traditional' lenders. As a result, defaulting countries at present typically owe the plurality of their debt to these newly dominant lenders. These new lenders - often Chinese institutions - are not members of the Paris Club and primarily lend to low-income countries. This development has represented a serious challenge to the pre-existing Paris Club framework for dealing with sovereign debt defaults. Moreover, some observers have claimed that the terms demanded by these new lenders have been unusually unfavorable to low-income borrowers, fueling concerns about the use of 'debt-trap diplomacy'. Based upon empirical analysis of newly-compiled comprehensive data, this thesis finds that while certain non-traditional bilateral creditors do engage in problematic lending practices - including contract provisions that forbid the use of the Paris Club or comparability of treatment - there currently exists little evidence to suggest that recent increases in Chinese lending have led to higher observed incidence of debt distress. Furthermore, there exists mixed evidence on whether Paris Club treatment results in improved macroeconomic outcomes for debtor countries. Notably, Paris Club debt restructuring does not appear to reduce the incidence of serial defaults when compared to sovereign debtors that do not receive such treatment.

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List of Acronyms

AUC	Area under the Receiver Operating Characteristic Curve
BoC	Bank of Canada
BoE	Bank of England
BIS	Bank for International Settlements
BRI	Belt and Road Initiative
CACs	Collective Action Clauses
CARI	China Africa Research Initiative
CDB	China Development Bank
CPIA	Country Policy and Institutional Assessment
DD	Default and Distress
DSA	Debt Sustainability Analysis
DSF	Debt Sustainability Framework
DSSI	Debt Service Suspension Initiative
EFO	Economic and Financial Organization
GDP	Gross Domestic Product
HIPC	Highly Indebted Poor Countries
HRT	Horn, Reinhart, and Trebesch (authors)
ICBC	Industrial and Commercial Bank of China
IDA	International Development Association
IDS	International Debt Statistics
IFI	International Financial Institution
ILO	International Labor Organization
IMF	International Monetary Fund
LIBOR	London Interbank Offered Rate
LIC	Low-Income Country
MAC	Market Access Country
MONA	Monitoring of Fund Arrangements
MoU	Memorandum of Understanding
NTS	Noise-to-Signal Ratio
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
PBoC	People's Bank of China
PC	Paris Club
PRGT	Poverty Reduction and Growth Trust
ROC	Receiver Operating Characteristic
SAIS	School of Advanced International Studies
SCDI	State-Contingent Debt Instruments
SDRM	Sovereign Debt Restructuring Mechanism
TAZARA	Tanzania-Zambia Railway Authority
UN	United Nations
WB	World Bank
WBG	World Bank Group
WEO	World Economic Outlook

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I. Introduction: China's Role in Sovereign Lending and Debt-Trap Diplomacy?

When news broke in December 2017 that China had seized control of Sri Lanka's Hambantota Port, participants ranging from both public and private credit markets to senior government officials suddenly wondered if the process of asset seizures represented the new-normal in how defaulting Chinese debt claims would be settled in the future (Ondaatjie and Sirimanne 2019; Pence 2018; Schultz 2017).

While the news of the Hambantota Port seizure made global headlines, many that had been following Chinese sovereign lending were already quite familiar with the issue. In fact, Sri Lanka's President Maithripala Sirisena had spent much of the previous year running on a platform centered on accusing the previous Rajapaksa government of engaging in opaque dealings with Chinese officials to fund pet projects (Sridharan 2018). The most notable of these was the Hambantota Port project; however, this was only one of multiple big-ticket projects that Rajapaksa was able to place in his home district of Hambantota. These also included a 35,000-person cricket stadium and a new international airport that has been dubbed the 'world's emptiest' (Hillman 2018). What made these projects so confounding to many critics was that they were backed by a seemingly endless amount of Chinese funding, despite numerous feasibility studies suggesting that none of them would ever be profitable (ibid).

After being unable to meet its payment obligations in 2017, the Sirisena government concluded that its best remaining option was to cede control over the Hambantota Port and 15,000 acres of surrounding land to a Chinese state owned

enterprise in order to abrogate its debt liabilities.[1] Despite the work of scholars such as Bräutigam (2019) showing that the case of the Port seizure was an aberration from typical Chinese debt renegotiations, that research was not sufficient to prevent immense media coverage focused on China's 'predatory lending' practices (Pence 2018) that result in asset seizures from poor countries after 'forcing' loans upon them, even if China is far from the first actor to do so.[2] Critics of these practices were quick to cite China's ambitious Belt and Road Initiative (BRI) as a calculated means to use "debt-trap diplomacy"[3, 4] to further extend its economic grasp over low-income countries (LICs; Green 2019), specifically targeting countries lacking the creditworthiness to repay these loans (Hurley, Morris, and Portelance 2019).[5]

The Objective of This Thesis

My objectives are to 1) review the emergence of international concerns about Chinese sovereign lending beginning in year 2000, with particular focus on the Paris Club as a lead organization in sovereign debt restructuring, and 2) use econometric methods to examine whether there is empirical evidence to support the aforementioned concerns regarding China.

[1] China Merchant Ports Holding Co. Ltd. acquired a 70% controlling stake in the Hambantota Port in exchange for the cancellation of US$1.12 bln. of loan claims.
[2] In fact, the most notorious example of large-scale asset seizure is likely the sale of the Suez Canal to Great Britain in 1875 after Egypt was unable to meet its payment obligations (Kolb 2011).
[3] Debt-Trap Diplomacy refers to a strategy of foreign policy by gaining either financial, economic, or political control over a foreign power through the intentional extension of credit beyond a country's reasonable ability to repay.
[4] For a detailed history of this term see "A Critical Look at Chinese 'Debt-Trap Diplomacy': The Rise of a Meme" (Bräutigam 2020a).
[5] As found by the Center for Global Development, 33 out of 68 BRI recipient countries were rated below investment grade or did not receive a credit rating. See Appendix for a complete list of these countries.

Questions surrounding the size and volume of Chinese sovereign lending, lack of transparency, and BRI incurred liabilities (especially relating to foreign currency exposure) are some of the critical macroeconomic questions of the 21st century and warrant further scrutiny and study (Morris 2020). Perhaps the more vital issue, however, regarding Chinese lending that has hitherto received little attention in academic or policy literature is how international coordination within the context of sovereign restructuring might be threatened as a result of these developments. In this thesis, I focus on a narrowly defined yet crucial aspect of the greater Chinese lending issue, i.e., whether China's role in bilateral lending and its decision not to accept membership into the Paris Club – the primary institutional forum designed around international coordination of sovereign defaults – while it was heading the G20 in 2016, is likely to undermine the existing framework and process to achieve coordinated outcomes in instances of sovereign default (Chin and Dobson 2016).[6] I do this by posing two fundamental questions: first, whether increases in Chinese lending since 2000 has resulted in higher observable incidence of sovereign default and distress, and second, whether or not countries that have received debt relief via the Paris Club observed statistically improved macroeconomic outcomes.

While China has, and to a lesser extent still does, engage in problematic lending practices that have posed challenges for debtor countries and institutions like the Paris

[6] "The [Paris] Club has been conducting extensive outreach to large emerging creditors to familiarize them with Paris Club practices. For example, China has participated in several of the Club's tour d'horizon sessions though it has not yet participated in a negotiation on an ad-hoc basis. Other countries such as South Africa have participated in negotiations on an ad-hoc basis. An expansion of the Paris Club to include, for instance, large emerging creditors is an issue for the Club to address and would likely be complementary to staff's proposal." See IMF, 2015c.

Club, based upon my empirical analysis of these questions, I find that an increase in Chinese lending has not led to higher observed incidence of distress episodes for borrowing countries. This finding supports earlier findings by Bräutigam that Chinese debt-trap diplomacy is, in practice, indeed a myth,[7] and that claims of its existence are not supported by empirical evidence. Further, the data on macroeconomic outcomes of countries that received debt relief via the Paris Club is mixed, at best, and does not sufficiently prevent countries from suffering serial defaults. The result of these findings is that an enlargement of Paris Club membership, while providing some benefits of transparency and cooperation amongst members, is unlikely to serve as a panacea for avoiding future sovereign defaults.

The Role of the Paris Club in International Debt Negotiations

The aim of the Paris Club is to provide debt relief by finding "coordinated and sustainable solutions to the payment difficulties experienced by debtor countries" (Club de Paris n.d.). It does this by harmonizing debtor claims before an international body in order to achieve a joint outcome. This aim is beneficial to the debtor and creditor countries (and the whole international system more broadly), as it reduces the time and costs required to achieve relief and is likely to result in the avoidance of a failed negotiation that would likely result in out an outright default.[8] As China has chosen not to join the Paris Club while continuing to act as an official observer (on ad-hoc status

[7] See Bräutigam and Rithmire, 2021.
[8] As noted by Rieffel, "The Paris Club has one truly remarkable characteristic. It is capable of completing a rescheduling agreement involving billions of dollars of obligations in eight to twelve hours of negotiations at no cost to the debtor other than plane fare to Paris and two days' lodging for its delegation" (1985).

through the People's Bank of China (PBoC; see Appendix), it has unique insight into global debt negotiations but is not bound by the outcome of said negotiations. As the importance and influence of the Paris Club is directly derived from membership across a critical mass of lender countries, the sudden rise in importance of a non-member country, such as China, has the ability to render the decisions of the Paris Club insignificant or ineffective if their members do not represent a critical mass of a debtor country's total liabilities. To put this more succinctly, if China's claims on a debtor country outweigh the total claims by members of the Paris Club, would this undermine the relevance of the Paris Club as well as its ability to serve as a 'port of call' for debtor countries seeking sovereign default resolution? If this is the case, how can existing institutions be strengthened to mitigate these new challenges? Alternatively, if these new rifts are sufficient to create a divergence of global economic institutions, what would the likely policy implications and risks associated with this process be?

Traditional bilateral sovereign lending programs, from initial design through restructuring, are being challenged by the rise of non-traditional sovereign lenders,[9] primarily dominated by China's growing economic and financial influence. Demand for additional capital, particularly from countries that have historically been excluded from international capital markets, has created new financing opportunities that have allowed Chinese sovereign lending to expanded tremendously in recent years (see Figures 1 &

[9] Traditional is defined as sovereign lending from Advanced Markets countries, typically defined by OECD membership. By definition, non-traditional lenders represent any sovereigns not included in the earlier list, but are predominantly made up of China, India, Saudi Arabia, UAE, and Qatar.

2).[10] This has led both recipients and proponents of Chinese lending to hail this new financing source as a potential catalyst of growth and development. It is important to note that, at least in the case of Africa, total debt owed to China on a bilateral basis has continued to increase, China's annual lending has slowed in recent years. As found recently by Acker and Bräutigam, "Chinese lending in Africa peaked in 2013, the year the Belt and Road Initiative (BRI) was launched. The decline since 2013 reflects China's current concerns about debt sustainability" (2021).

Figure 1. Total Direct Sovereign Loans Owed to China

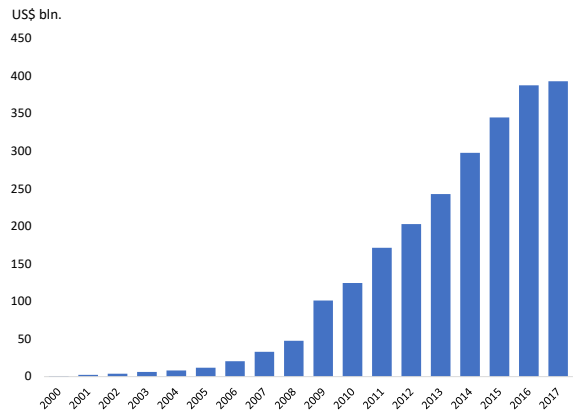
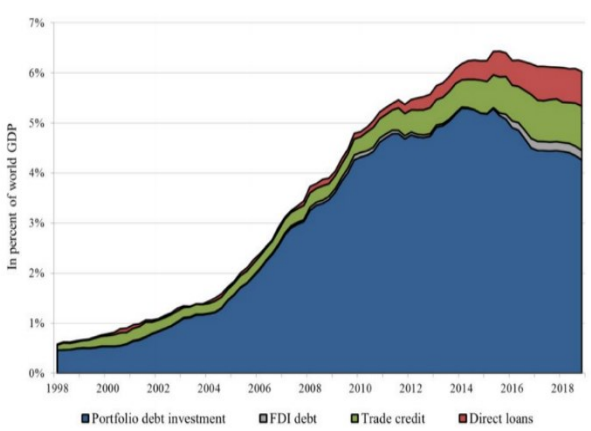


Figure 2. Total Global Debt Owed to China, by Creditor Type, %



Note: Figure 1 shows the annual total amount of direct lending, i.e., loans from Chinese creditors to borrowing countries, in billions of US$. This amount has grown from near zero in 2000, to c. US$ 393 bln. in 2017. Figure 2 shows the total amount of credit owed to China by borrowing countries. This figure includes all direct lending shown in Figure 1 as well as publicly traded debt, foreign direct investment, and trade credits, measured in percent of global GDP. While this amount has declined from a peak in 2015, as of 2018, this amount remains above 6% of global GDP.
Source: Source: Horn, Reinhart, and Trebesch 2019.

Notwithstanding the potential benefits of new financing, of which, at least "80 percent [have] financed economic and social infrastructure projects" (Acker and

[10] Between 1998 and 2018, the total debt owed to China increased from less than 1% of global GDP to over 6%; per World Bank figures, c. 20% (US$ 1.1 trillion) of total Chinese holdings are held in US Treasury Securities.

Bräutigam 2021), Chinese lending has introduced new practices that are both opaque and not well understood by "other government creditors" (Morris 2020). This lack of understanding raises concerns about the effectiveness of international bodies such as the International Monetary Fund (IMF), the World Bank (WB), or the Bank for International Settlements (BIS), to monitor these flows and to fully evaluate all risks involved, ultimately leading to questions about the long-term consequences of these new practices. As an example, recent work by the Center for Global Development shows that Chinese lending as part of BRI has significantly increased both debt-to-GDP and debt-to-China of many low-income countries, raising concerns of changes in debt composition and foreign currency exposure (Hurley, Morris, and Portelance 2019). While the highly scrutinized 'seizure' of the Hambantota Port has received the lion's share of media attention, the outcomes in other bilateral negotiations involving China were not known until recently. Nearly all of these negotiations have resulted in deferred payments or write-offs (Kratz, Feng, and Wright 2020; see Appendix).[11] As noted by Acker, Bräutigam, and Huang, "Chinese lenders prefer to address restructuring quietly, on a bilateral basis, tailoring programs to each situation" (2020). The frequency of modifications suggests that China does appear willing to engage in debt forgiveness or reprofilings in cases where recipients are unable to meet their obligations. However, it also suggests that many loans were extended to debtors unable to repay and/or on terms that were too onerous. A more cynical interpretation might suggest that these modifications are merely a subset of the total modifications desired by borrowers, others

[11] In fact, it is only recently, through investigative work by SAIS CARI and AidData that the outcomes of these negotiations have come to light.

might not have been achieved, or borrowers might have been pressured into not formally seeking modification. As recently noted by Gelpern et al. it “is entirely possible that some of the contract features we identify serve an [express] purpose, or function in terrorem, to dissuade the debtor from taking steps adverse to the creditor’s interests” (2021). As these negotiations (and even outcomes) are rarely made public, it has led to further speculation surrounding the intent of Chinese lending. For an overview of the history of sovereign debt restructuring mechanisms, see Box 1.

Mechanism of the Paris Club

The creation of the Paris Club, while not holding the legal authority of a court, has sought to create a greater degree of dialogue between both debtor and creditor countries that are willing to provide collective debt relief in exchange for the host country accepting conditions of macroeconomic reform that are part of a required IMF program (Buchheit et al. 2019; Imam 2008). Since its formation, there have been 433 separate claims treated from 90 different countries, totaling US$583 billion (Club de Paris n.d.). What makes these figures more remarkable is not the size of the claims treated, but rather that these outcomes were decided using consensus and information sharing amongst member countries (as outlined in the Six Principles of the Paris Club; see Appendix). The Paris Club seeks to harmonize debtor claims before an international body in order to achieve a joint outcome. This is beneficial to both the debtor and creditor countries. In the case of the debtor country, they are able to negotiate with multiple creditors simultaneously, thus significantly reducing the time and costs required to achieve relief, resulting in increased efficiency of the process. A coordinated

negotiation is also likely to increase its efficacy of treatment[12] as it would be provided by a higher number of creditors than if repeated individual negotiations were to occur, benefiting both debtors and creditors. Furthermore, if the intent of relief provided is to restore both fiscal and debt sustainability to the host country, it is vital that the treatment (and coinciding IMF program) is designed with full information regarding the country's liabilities, which could only be achieved through a coordinated process.[13]

Given the frequency of serial defaults of countries that receive debt relief via the Paris Club,[14] defined as subsequent default following an initial restructuring, as well as the costly and protracted negotiations that are required to achieve debt relief, it would be difficult to argue that the existing framework is an ideal solution (Kohlscheen 2007). As a result, alternative resolution structures have been put forth, most notably in 2002 by Anne Krueger,[15] who proposed a binding 'Sovereign Debt Restructuring Mechanism' (SDRM) that would automatically trigger a restructuring if certain conditions were met and overseen by the IMF (Krueger 2002). The SDRM failed to gain large scale support by private creditors, who objected to being subjugated to the jurisdiction of an international body and, ultimately, was not adopted by the IMF's Executive Board.[16] Renewed attempts at creating a binding mechanism within the structure of the Paris Club signify that there exists desire for greater degrees of international cooperation on

[12] "Treatment" is the accepted term referring to the debt relief and/or rescheduling of official obligations under the Paris Club.
[13] As defined by the ability of the country to finance its internal and external obligations through taxation and exports while preventing an explosive path of debt.
[14] A detailed measure of serial defaults is presented throughout Chapter 2.
[15] Then serving as the First Deputy Managing Director of the IMF.
[16] The SDRM proposal was most notably vetoed by the US Treasury, which did not want to be bound to providing relief when it might be politically unpopular (Block-Lieb 2015).

these issues (Block-Lieb 2015). It is precisely for these reasons that the growing importance of non-traditional bilateral creditors that has, so far, resulted in less cooperation, is creating concerns about the future of sovereign negotiations and the role of the Paris Club.

If forums such as the Paris Club do, in fact, provide a better alternative to the haphazard and occasionally violent[17] outcomes of the past (by increasing creditor and debtor coordination and reducing the number of outright defaults), then it will be vital to maintain, or even strengthen, these forums in the restructuring process and avoid a return to an uncoordinated process across multiple creditor countries, each with different intents and degrees of willingness to exercise forgiveness.

To my knowledge, international financial organizations (IFIs) such as the International Monetary Fund and World Bank lack a framework to systematically deal with the situations that result from the growing importance and volume of lending stemming from non-traditional bilateral lenders, at least within the bounds of the Paris Club. While the IMF's Debt Limits Policy (IMF 2015b) is designed to require pre-approval of debt contracting by borrower nations to reduce the likelihood of both hidden debts and defaults, this policy only applies to a small subset of countries (IMF 2015b);[18] additionally, it is not designed as an ex-post mechanism where a default has already occurred. More recently, the G20's 'Common Framework' (See Box 2), aims to address issues of non-traditional bilateral creditors by binding all signatories of the G20 to a

[17] See Box 1 on a discussion of 'gunboat diplomacy'.
[18] The IMF Debt Limits Policy only applies to Poverty Reduction and Growth Trust (PRGT) eligible countries, which, by definition, are classified as low-income. For a full list of low-income countries, see Appendix.

comprehensive framework of debt relief. While the Common Framework does include China, the new membership would only extend as far as G20 membership, in addition to existing Paris Club members,[19] resulting in many creditors still being excluded from binding action. Furthermore, due to organizational constraints of the IFIs, it is difficult to address these issues directly and openly; for example, in the case of the Paris Club, of which China is not a member, the body is free to address its concerns about the rise of Chinese lending. In the case of the IMF, however, where China is a member (and one of growing importance; IMF 2020b), it is politically challenging to publicly discuss matters of importance that are the direct result of the practices of one of its own member countries, often leaving debtor countries and commercial creditors in the dark regarding China's role in a restructuring.

Why is Sovereign Lending Outside of the Paris Club a Problem?

The difficulties with having a sovereign lender outside the Paris Club can be divided into two main issues. One is the ability of the outside sovereign lender – here China – to prevent the Paris Club/IMF from initiating a package of relief for the debtor country. The second is the ability of the outside lender to avoid partaking in equal burden-sharing following Paris Club treatment.

The ongoing cases of Zambia and Angola provide two contrasting examples of how China as an outside party can complicate a country's restructuring process even

[19] Additional countries included in G20 membership that were not already members of the Paris Club are: China, India, Indonesia, Mexico, Saudi Arabia, South Africa, and Turkey. For a full list of G20 members, see Appendix.

prior to a country receiving assistance from the IMF and the Paris Club (see Box 3 for a detailed discussion on both Zambia and Angola). In the case of Zambia, the IMF has deemed that an upfront restructuring must take place before an IMF program can be initiated (IMF 2015a). Being unwilling to restructure key loans in Zambia, China has effectively blocked both the possibility of an IMF program or Paris Club treatment, ultimately resulting in a default by Zambia on its commercial creditors. In Angola, China's willingness to restructure key loans has allowed an IMF lending program. The result is that Angola remains current on its commercial creditors and would be eligible for future Paris Club treatment if requested. In either case, however, China retains a blocking position, allowing it to determine a debtor country's outcome.

The second scenario, relating to China's ability to avoid equal burden-sharing across creditors after Paris Club treatment has been obtained needs a closer look and is illustrated in the Republic of Congo.

The Example of the Republic of Congo: Avoidance of Burden-Sharing?

The ongoing Paris Club negotiations on the Republic of Congo are likely to serve as a critical test case, being the first international debt restructuring that will require an IMF program, Paris Club treatment, and also substantial input and agreement from China. The presence of China can pose problems both during the restructuring negotiations and also following any restructuring by the Paris Club. China as the largest creditor will have substantial influence over the negotiations (holding more than 30% of the total external public debt and nearly 75% of the official bilateral debt (see Table 1.;

IMF 2020a). The immediate concern is a clear coordination issue amongst the relevant parties (i.e., Paris Club members vs. non-members) whose interests conflict.

Table 1. Republic of Congo Debt Stock, as of September 2019

	% of GDP[1]	% of Total Debt	% of External Debt	% of Official Bilateral
Total PPG Debt[2]	85%	100.0%	140.8%	320.9%
Domestic Debt	25%	29.0%	40.8%	93.0%
External Debt	60%	71.0%	100.0%	227.8%
Commercial	34%	39.8%	56.1%	127.8%
Official Bilateral	27%	31.2%	43.9%	100.0%
o/w Paris Club	3%	3.7%	5.2%	11.9%
o/w China	**20%**	**23.2%**	**32.7%**	**74.4%**
Other Non-Traditional (incl. arrears)	4%	4.2%	6.0%	13.6%

1/ Republic of Congo 2019 Nominal GDP in US$ (millions); 11,206

2/ PPG = Public and Publicly Guaranteed Debt

Note: Table 1 shows the Republic of Congo's total public and publicly guaranteed debt as a percent of GDP, total debt, external debt, and official bilateral debt. The figures of note are shown in bold, those being the amount of official bilateral debt owed to China; making up 20% of GDP, 23.2% of total debt, 32.7% of external debt, and 74.4% of official bilateral debt (compared to only 11.9% owed to all remaining Paris Club creditors).
Source: IMF 2019 Republic of Congo Article IV Staff Report & Author calculations.

China, by far the largest international creditor that is not a Paris Club member (generally, as well as specifically with respect to the Republic of Congo), enjoys a unique second-mover advantage over both the IFIs and other creditors as it is not bound by the solidarity principle required of Paris Club membership that ensures equal treatment. The only enforcement mechanism available to the Paris Club is an agreement that the debtor country must seek to achieve 'comparability of treatment' from non-members, i.e., that they attempt to receive terms of relief from non-members on terms that are at least as beneficial as those that were provided by the Paris Club (Club de Paris n.d.). This situation results in one where China is incentivized to allow

the Paris Club to move first and provide the largest possible relief package, effectively recapitalizing the country to the point where it would be able to repay China in full (Ross 2019).

Lack of Transparency in Chinese Sovereign Lending

Unfortunately, this issue is further complicated by the nature of 'Chinese' loans, which are frequently not made by the government itself but instead through sub-national or quasi-sovereign institutions, often at the behest of the Government (Chen 2020). While directed lending is not necessarily atypical, what makes the Chinese case unique is that nearly all state sponsored loans include non-disclosure agreements, making it difficult not only to determine the terms of lending but also to identify who the lender is. As noted by SAIS CARI, there "is no 'China Inc.' when it comes to debt relief. More than 30 Chinese banks and companies have provided credit to African governments" (Acker, Bräutigam, and Huang 2020). The lack of transparency surrounding much of China's overseas lending makes it difficult to measure a country's total debt burden, as was noted by Gulde (2018) with respect to the Republic of Congo, and more generally by David Malpass, the current President of the World Bank (2020). Furthermore, recent work by Gelpern et al. (2021) finds that Chinese loan contracts that contain 'confidentiality clauses' are actually increasing over time, with all loans after 2015 showing their inclusion. A lack of transparency is associated with additional issues; as recently noted by Mustapha and Olivares-Caminal, "transparency of the debts owed by governments and the guarantees they have given is an important issue for the international community. The increasing risk of debt distress in many of the world's

poorest countries, coupled with several recent cases of inadequate disclosure that put macroeconomic stability at risk, have highlighted the urgent need to make lending to governments more open, particularly the terms and conditions. The underlying assumption is that more disaggregated information on public debt will enable borrowers and lenders to make more responsible borrowing and lending decisions, ultimately making a debt crisis less likely. Better quality data can also directly impact sovereign ratings and, by extension, lower borrowing costs" (2020).

Creditor Classification and Seniority

Beyond the questions surrounding transparency of lending, the issue of creditor classification is a challenge that frequently arises in private restructurings, those being with private creditors such as bondholders or loan holders. The issue is determining which instruments should or should not be included in the restructuring process. This process, known as ringfencing, arises via the discussions between the debtor and the creditor committee to determine which, if any, instruments are considered 'senior' (e.g., recourse loans that are guaranteed through assets generated by a certain project or commodity export) and therefore exempt from incurring any write-downs during the restructuring process, or which claims should be considered 'junior' (e.g., non-recourse loans) and therefore eligible to be written down or cancelled. While this process is a mainstay of a private restructuring, it is less common when negotiating with official creditors where seniority of the claim is based solely on the creditor, rather than the instruments themselves. As often cited in the literature on sovereign restructurings,

official lenders[20] are deemed to be senior to claims by commercial creditors (Cordella and Powell 2019; Ari, Corsetti, and Dedola 2018).

A second category of seniority can stem from a timing issue. If we consider a typical default/restructuring scenario for example, it is not uncommon for creditors to provide additional financing to a country that is already in payment arrears to other creditors (including itself). This financing is generally provided on relatively onerous terms to the borrower; however, it is likely necessary in order to continue the successful day-to-day operations of the country. Before a creditor is willing to put in this additional financing, they generally require that a commitment from the debtor that any new financing provided after a certain date, known as the "cut-off" point/date, will be excluded from any future restructuring (Edwards 2015). Thus, even claims by the same creditor that fall under the same asset categorization could see varying levels of seniority based upon the time when the financing was received.

Given the complexities involved in determining which claims are truly senior when comparing across both time and creditor, seniority is often simply assigned based upon the ease with which a debtor can, in practice, restructure its claims. This challenge was succinctly summarized by Schlegl, Trebesch, and Wright who state: "the typical debtor has many creditors. Hence, a debtor that is unable to pay must choose which debts to repay and on which debts to default. For individual and corporate borrowers, contract and bankruptcy law determines which creditor gets repaid first; creditor seniority is a straightforward legal issue. In contrast, for the foreign creditors of a

[20] 'Official lenders' refers to international organizations, governments and government agencies including official monetary institutions (OECD 2001).

sovereign government, the lack of an international bankruptcy regime combined with the difficulty of enforcing sovereign contracts makes creditor seniority a matter of custom and convention. By this convention, the debts of multilateral government lenders such as the International Monetary Fund (IMF) and World Bank are senior to the debts of all other government creditors, which are in turn senior to the bonds and bank loans owed to private sector creditors. Relying on this convention, government creditors have been able to lend at relatively low interest rates, even in times of financial distress" (2019).

Issues of seniority came to a head throughout the 1980s in what became known as the Latin America Debt Crisis (Sims n.d.). Many of the sovereign defaults that occurred during this period stemmed from liabilities owed to a small number of commercial and investment banks located in the United States and the United Kingdom, that had lent using 'syndicated loans' (Sachs and Huizinga 1987; Reinhart and Rogoff 2011). This relatively homogenous creditor base changed dramatically throughout the 1990s in part due to the restructuring of these liabilities as part of the Brady Plan (Peters 1993), that allowed countries to securitize bank loans into tradeable securities backed by U.S. Treasury Bonds and, ultimately, leading to the birth of the secondary market for emerging market debt. Throughout this period, a substantial literature began to emerge to cover the challenges that a restructuring would pose due to diverse and heterogenous commercial creditors, including the inclusion of collective action clauses or floating rate instruments.[21]

[21] For a detailed discussion on collective action clauses of state-contingent (floating rate) debt instruments, see Bredenkamp et al. (2019).

As noted by Panizza, Sturzenegger, and Zettelmeyer (2009), these concerns largely proved to be immaterial, and in fact, the duration of the restructuring period (being representative of the efficiency of the process) was largely driven by debtor, rather than creditor, characteristics. This conclusion, however, misses one important aspect, that being that it focuses on private obligations such as bank loans and Eurobonds rather than on official sector lending. As sovereign balance sheets have grown increasingly varied and complex, frequently featuring “bank and bonded debt…large exposure to highly structured and often nonconventional project and trade debt, derivatives, repurchase obligations, commercial claims, secured debts, and a panoply of contractual obligations…. creditors of sovereign borrowers have themselves become more diversified” (Rhodes et al. 2021). This growing complexity of sovereign balance sheets includes lending from the official sector. As official sector lending was historically found to be relatively homogenous, there exists a lacuna in traditional policy literature to address how a growing number of diverse official creditors and instruments could result in protracted restructurings.

Seniority and Classification of Chinese Claims

As previously discussed, if the intent of relief is to restore both fiscal and debt sustainability to the host country, it is vital to minimize information asymmetries in order to achieve a package of debt relief that is sufficient to avoid a subsequent default (Guzman and Lombardi 2017; Buchheit et al. 2019). Using directed lending via quasi-sovereign institutions creates a secondary issue, namely how these liabilities should be classified. Government lending is typically classified as “official” lending, rather than

"private," and receives added seniority in claim. This means that if a party defaults, official claims are generally settled, or paid out, in full prior to any private claims receiving compensation. This issue of classification of Chinese loans is problematic as we still lack systematic precedent as to whether loans by quasi-sovereigns should be considered official or private. As a result, even in a situation where China were voluntarily willing to commit to equal treatment of relief, we would still be unsure of which liabilities would be included as part of its official lending, and therefore, which liabilities would even be eligible for treatment.[22] In fact, as part of Angola's recent negotiations with the Paris Club and G20 regarding the Debt Service Suspension Initiative (DSSI), two Chinese creditors that were deemed outside the scope of official lending (and thus outs the scope of DSSI), partook in a separate voluntary rescheduling of claims (see Box 3).[23]

Beyond issues of classification, recent work by Gelpern et al. (2021) has uncovered a more troubling trait that is unique to Chinese loans, i.e., that they included specific 'No Paris Club' clauses. The authors found that every loan within their sample contained express wording that "commit the borrower to exclude the debt from any multilateral restructuring process, such as the Paris Club of official bilateral creditors, and from "comparable treatment" (ibid). Thus, even in cases where all common attributes of a loan suggest subordinated status, the 'No Paris Club' clause could in

[22] In response to the Covid-19 pandemic, China has voluntarily agreed to participate in the G20 Debt Service Suspension Initiative (DSSI) moratorium on official sector debt repayments, however, any obligation classified as BRI related can be unilaterally exempted by assigning it preferential status, creating further uncertainty around issues of classification and intent (Steil and Della Rocca 2020) though this has been disputed, see Bräutigam (2020b).
[23] The creditors were China Development Bank (CDB) and the Industrial and Commercial Bank of China (ICBC). See IMF 2021a.

effect, endue the loan with de facto seniority based upon the debtor's contractual requirement to exclude the claims from a restructuring and subsequent need to seek comparability of treatment. Although the recent ratification of the G20's Common Framework, that requires equal burden sharing as well as transparency of claims held by signatory states, points towards China's willingness to seek solutions without the need for enforcement of all contractual clauses, this development could, de facto, negate China's ability to enforce prior contractual obligations.

Summary of China's role in Sovereign Lending

While we are likely still years away from witnessing the outcome of the current negotiations between the Paris Club, China, and the Republic of Congo, it is certain to shed light onto the potential relevance of the current institutional framework for addressing questions of sovereign default, especially with regard to how China is willing to rank its claims by seniority. A preemptive restructuring of commercial claims, as was the case in Angola (see Box 3) symbolizes a willingness by China to further integrate into the existing institutional framework.[24] However, if China opts not to restructure its claims, the outcome would likely result in a contentious situation like the one we are observing in Zambia (ibid). Furthermore, the latter outcome would foreshadow greater degrees of policy divergence between China and traditional sovereign lenders.

[24] Prior to China's voluntary participation in the G20's Debt Service Suspension Initiative (DSSI), China had only taken part in one Paris Club restructuring, the 2003 treatment of US$250,000 owed by the Kyrgyz Republic (Hurley, Morris, and Portelance 2019).

If the latter were to occur, greater questions begin to emerge, including whether or not China would create a default resolution mechanism that lies outside of the existing framework, i.e., a rival 'Beijing Club' (Culverhouse and Dielmann 2019), and whether this would undermine the relevance of our current institutional forums. Furthermore, what impact would this shift in institutional design have on the future of bilateral lending as well as private credit markets more broadly? For example, both public and private creditors could simply refrain from lending to countries that are deemed to have excessive liabilities to non-Paris Club members on the grounds that repayment issues might result in a disorderly restructuring. As found by Mustapha and Olivares-Caminal, "non-Paris Club bilateral lenders are rarely part of an established creditor coordination and information-sharing group and are not necessarily bound by Paris Club terms, principles and standard disclosure requirements. Consequently, their behavior is generally considered less predictable should a sovereign borrower face financial distress" (2020). Alternatively, if the commercial creditors are indeed willing to lend, they would require higher rates of return (via interest payments) from the debtor country to compensate them for the additional risk and uncertainty that a disorderly default process would entail, as has been shown in the literature.[25] Not only would this dramatically alter creditor and debtor behavior, but it would also result in longer-term development issues for borrowing countries associated with less access to capital and/or at higher expense, which was supported by Lang, Mihalyi, and Presbitero. who

[25] Work done by the IMF has found that Eurobonds containing collective action clauses (CACs) trade at lower yields than non-CACs series as creditors internalize the benefits of orderly restructurings (IMF 2015a).

find that “countries eligible for official debt relief experience a larger decline in borrowing costs compared to similar, ineligible countries” (2020).

Up to this point I have looked at the general and potential problems that can be caused by the character of loans by China and Chinese quasi-sovereign institutions to sovereign nations. In Chapter 2, I will use statistical methods for default prediction in order to attempt to determine whether these potential problems have in fact caused significant detriment to sovereign debt restructuring involving the Paris Club and other entities such as the G20 and the IMF.

Box 1. A Brief History of Sovereign Restructuring Mechanisms

"But if they do not acquire the means to repay, what was sold will remain in the possession of the buyer until the Year of Jubilee. It will be returned in the Jubilee, and they can then go back to their property." – Leviticus (25:28)[26]

To understand why the rise of non-traditional bilateral lending is creating new challenges, we must briefly consider the history of debt relief. This concept can be traced throughout antiquity[27] and is a common element of the Old Testament, most notably in the Book of Leviticus, which proclaimed that all debts and servitude should be canceled in the 7th Sabbath year (every 49 years; Khan 2015). Furthermore, Reinhart and Rogoff found that sovereign write-offs and restructurings have been a "key part of every major period of financial crisis" (ibid). As common as these events have been throughout history, it was not until 1919, with the creation of the Economic and Financial Organization (EFO) of the League of Nations that an international body was formed to directly address issues of sovereign borrowing (Flores and Decorzant 2016). This body helped to establish the precedent of coordinated debt relief among European nations that were suffering from financial crises during the 1930s (Reinhart and Trebesch 2014). It was not until the establishment of the Paris Club[28] in 1956, however, that a body was created with the express intent of providing a forum for low-income countries seeking debt relief (Club de Paris n.d.).

Prior to the creation of these bodies, debt negotiations tended to follow unpredictable paths; frequently resulting in outright defaults, repudiation, and in certain instances, the use of violence during the era of gunboat diplomacy (Dolzer and Schreuer 2012). In one instance, after Venezuela was unable to meet its

sovereign obligations, “Great Britain, Germany, and Italy blockaded Venezuelan ports and shelled coastal fortifications, compelling Venezuelan compliance” (Kolb 2011). These outcomes, being at extreme ends of the spectrum in terms of benefits for either the creditor or the debtor, clearly do not represent efficient outcomes.

The unpredictable nature of default resolutions is driven by a common element of sovereign debt in that there does not exist a bankruptcy court with jurisdiction over these matters. This is a unique element of sovereign defaults as all non-sovereign claims can be adjudicated via domestic courts or international mediation. For example, a defaulting private entity (e.g., person or corporation) in a non-sovereign context could seek recourse for their damages via a domestic court. A creditor in a sovereign default situation has to rely solely on their persuasive power to convince the debtor to repay, the debtor country’s fear of losing its ability to borrow from international capital markets in the future (Eaton and Gersovitz 1981), the threat of sanctions (Bulow and Rogoff 1989), and, in rare instances, the ability to attach assets if they are located outside of the debtor’s jurisdiction, as was the case when a New York based hedge fund managed to seize an Argentine naval vessel that had been docked in Ghana (Schmall 2012).

[26] Bible Gateway Leviticus 25 :: NIV.
[27] At least 30 general debt cancellations have been counted between the years 2400 and 1400 B.C. (Khan 2015)
[28] “The Paris Club is an informal group of official creditors whose role is to find coordinated and sustainable solutions to the payment difficulties experienced by debtor countries. As debtor countries undertake reforms to stabilize and restore their macroeconomic and financial situation, Paris Club creditors provide an appropriate debt treatment. Paris Club creditors provide debt treatments to debtor countries in the form of rescheduling, which is debt relief by postponement or, in the case of concessional rescheduling, reduction in debt service obligations during a defined period (flow treatment) or as of a set date (stock treatment)” (Club de Paris, n.d.).

Box 2. The G20's Common Framework for Debt Treatments beyond the DSSI

Recognizing the need for a more comprehensive framework to deal with sovereign defaults and restructurings beyond the scope of the Paris Club, in November 2020, the G20 ratified the 'Common Framework for Debt Treatments beyond the DSSI' (Club de Paris 2020b). The new framework expands the list of creditor countries to include all members of the G20 in addition to the existing members of the Paris Club and would require all members to provide equal burden sharing in providing relief to countries that are deemed eligible. The "process will be initiated at the request of a debtor country. The need for debt treatment, and the restructuring envelope that is required, will be based on an IMF-WBG Debt Sustainability Analysis (DSA) and the participating official creditors' collective assessment" (ibid). As of March 2021, Chad, Ethiopia, and Zambia have requested debt treatment via the new Common Framework (Golubski and Holtz 2021).

However, questions remain as to how the Common Framework will be implemented in practice. As the current agreement consists only of a 2-page document providing broad guidance, many details of practice will need to be established on a case-by-case basis through the "legally non-binding document, named "Memorandum of Understanding" (MoU), to be signed by all participating creditors and by the debtor country" (Club de Paris 2020b). As Suckling as noted, "at present, the G20 has provided very few details on how the Framework will be operationalized, aside from specifying the IMF's role in assessing debt sustainability and providing program support, with the Fund to retain its preferred creditor status.

Participants are expected to undertake the IMF's Debt Sustainability Assessment (DSA) and an IMF program involving policy reforms and provision of additional IMF financing" (2021).

Additional concerns have been raised that, despite the intentions of the G20's Debt Service Suspension Initiative (DSSI), the lack of private sector involvement resulted in only 24% of total debt service payments of the 73 eligible countries (see Appendix for full list of DSSI eligible countries; World Bank 2021). Additionally, due to fears of repercussions from private creditors, only 44 out of the 73 eligible states have opted for participation (Fresnillo 2020). An additional concern lies with the new Common Framework: namely, how to coordinate restructurings across both private and official creditors, and how will many of China's creditors be classified. As we have seen in the case of Angola (see Box 2), despite classifying the China Development Bank and the Industrial and Commercial Bank of China as commercial rather than official creditors, this action was taken unilaterally by China, which reserves the ability to classify creditor status at will in future restructurings on a case-by-case basis as outlined in the MoU of the Common Framework. As noted by Munevar, "private creditors will refuse to agree to debt write-offs unless commercial creditors from China participate on similar terms. Under the principle of comparability they will have the right to do so" (2020). While the new Common Framework is certainly a step in the right direction in terms of expanding the official creditor base required for burden sharing, many questions remain as to whether this approach will be sufficient in resolving future restructurings. Furthermore, as noted by J. P. Morgan, while the

Common Framework amends the fora for sovereign restructurings, it does not entirely replace existing avenues. It is therefore “conceivable that parallel discussions among private creditors, the Paris Club and the debtor country could be taking place, but these would not officially fall under the umbrella of the Common Framework” (2021).

Box 3. What Lessons have we learned from Zambia and Angola?

Zambia:

During the period of 2010 to 2020, Zambia saw its debt to GDP ratio increase over 600%[29] and, ultimately, result in a default after the country missed payments on US$ 42.5 mln. worth of coupon payments (after 30 days grace) due on 14 October, 2020. The missed payments marked a new chapter in a fraught situation that had been developing for a number of years, with growing concerns by private creditors over the lack of transparency involving Chinese lenders in the country. As noted by the IMF's 2019 Article IV Report, "increased borrowing to finance large capital expenditure has led to a sharp increase in external debt and a shift in the creditor composition….There has also been a noticeable shift toward more non-concessional borrowing. Non-Paris Club official creditors hold about 29 percent of total outstanding external PPG debt, followed by Eurobond holders (25 percent), foreign banks (19 percent), and foreign investors holding local currency debt (6 percent)" (IMF 2019).

In September 2020, Zambia attempted to avert default by issuing a consent solicitation notice to creditors requesting a voluntary restructuring of claims (Republic of Zambia 2020), however, this offer was rejected by creditors on grounds that a "1) lack of transparency on Chinese debt and how it will be treated relative to Eurobonds; and 2) lack of meaningful progress towards an IMF program" (Curran 2020). This has sparked disagreement between the country's Ministry of Finance, whose minister Bwalya Ng'andu, noted that, "we've given all the information that needs to be given concerning the Chinese debt" (Olander 2020). Furthermore, during the grace period,

the country announced that it had reached an agreement with the China Development Bank (CDB) on the deferral of payments owed (Yamba 2020). This comes in addition to various other deferrals and cancellations on Chinese creditors in recent years, including: US$ 40 mln. in 2001; US$ 211 mln. on debt incurred during the 1970s to finance the construction of the TAZARA railway line in 2006; cancellation of US$ 8 mln. in 2007; cancellation of 50% of the remaining US% 150 mln. owed by TAZARA in 2011; and on-going negotiations of up to US% 4.4 bln. since 2017 (Kratz, Feng, and Wright 2019; Hurley, Morris, and Portelance 2019).

Private creditors, however, remain unsatisfied with the current level of transparency, citing that "creditors have not received detailed information on the Chinese debt" (Olander 2020) and that the recent deferral of CDB payments only constitute a small amount of total Chinese claims (US$ 391 mln.) out of a total of US$ 9.9 bln. owed (SAIS CARI n.d.).[30]

Given that Zambia is already considered at 'high risk' of external debt distress (see Appendix Table 14. IMF List of Low-Income Countries; IMF 2021b), it is likely that the IMF would require a restructuring of private claims prior to engaging in a lending operation with the country (IMF 2015a). Private creditors, on the other hand, appear unwilling to relinquish their claim to the seniority of Chinese creditors through a restructuring, especially without the presence of an IMF program. This is especially the case given the strong stance taking by the creditor committee that "holds c40% of

[29] Zambia's debt to GDP increased from c. 19% in 2010 (a low base following its HIPC completion point in 2005; African Development Bank 2019) to c. 120% of GDP in 2020 (IMF 2020c)
[30] Total debt owed to China is c. 71% of Zambia's GDP, which was US$ 14 bln. in 2020 (IMF 2020c)

Zambia's Eurobonds (with a blocking across each of the three issues) and that is reportedly in "close contact" with another 30% of bondholders, creditors will have significant influence of how the restructuring unfolds" (Curran 2020). Given these constraints, it appears that the situation will remain at a standstill until an adequate degree of transparency regarding total Chinese claims can be established that will alleviate the concerns of both the IMF and private creditors.

Angola:

Angola's situation regarding Chinese creditors shares some similarities with that of Zambia, albeit, not nearly as fraught, largely as a result of the country not having missed any scheduled payments as well as currently being in an IMF program (IMF, 2021a). However, borrowing from China in Angola is significantly higher than in Zambia in nominal terms (US$ 42.6 bln. compared to US$ 9.9 bln.; SAIS CARI Loan Data n.d.) and roughly equal in terms of GDP (c. 68% in Angola compared to c. 71% in Zambia).[31] As a result of remaining current on its payments, there is currently no impasse between the country and private creditors as is the case in Zambia; however, China's lending has been a keystone in recent discussions between the country and the IMF, as well as the G20. In partaking in the G20/Paris Club's Debt Service Suspension Initiative, Angola also agreed to seek relief from its bilateral creditors (Club de Paris 2020a) as was the case for further engagement in its IMF program; as noted by IMF's Executive Board in its third program review in September, "the

[31] Angola's 2020 GDP was US$ 62.74 bln. (IMF 2020).

[Angolan] authorities have secured debt reprofiling agreements from several large creditors to reduce risks related to debt sustainability. Continued vigilance in managing public debt is critical to mitigate such risks in the context of heightened oil-price volatility" (2020). The most recent Staff Report (fourth review; IMF 2021a), noted that the referenced creditors were the China Development Bank (CDB) and the Industrial and Commercial Bank of China (ICBC) and that both had reprofiled the terms of loans over a three-year period (Arnold 2021).

Lessons from China's Involvement in Sovereign Restructurings:

The cases of Zambia and Angola offer important lessons in how China's role in sovereign lending can shape the outcome of pre-emptive default resolutions. In the case of Zambia, despite a willingness to restructure part of its claims, a lack of transparency and unwillingness for further restructuring has created a stalemate situation. In effect, the unsustainable nature of Zambia's debts prevents an IMF program from being initiated, which would be required for a subsequent Paris Club treatment, ultimately, resulting in a default on commercial creditors. In the case of Angola, China has offered a higher degree of transparency and willingness to reprofile claims, which has allowed Angola to receive treatment under the G20's Debt Service Suspension Initiative, as well as to remain on-track in its IMF program. This divergence in outcomes highlights a fundamental issue, which is that China's ability to preemptively engage with debtor countries can determine the outcome of whether countries will be able to receive debt relief or not. It does appear, however, that

China's lending patterns are shifting, partially in order to prevent being in situations with excessively high risk of not being repaid and/or find themselves at the center of global debates surrounding sovereign defaults. As noted by Acker and Bräutigam, "data on Chinese lending to Africa from the past 10 years shows that Chinese financiers adapt to changing economic and political conditions in Africa as they learn from experiences with borrowers in debt distress and debt restructuring negotiations. Rather than continuing to blindly dump finance into countries with debt issues, Chinese financiers have shifted away from these countries - albeit belatedly in some cases, such as Zambia - and towards borrowers with stronger economies and debt management" (2021). As previously discussed (see Box 1), Zambia's request for debt treatment through the G20's Common Framework will serve as an early indicator of whether this new forum will offer recipes for countries to avoid default in the future.

II. Measuring the Impact of China's Sovereign Lending

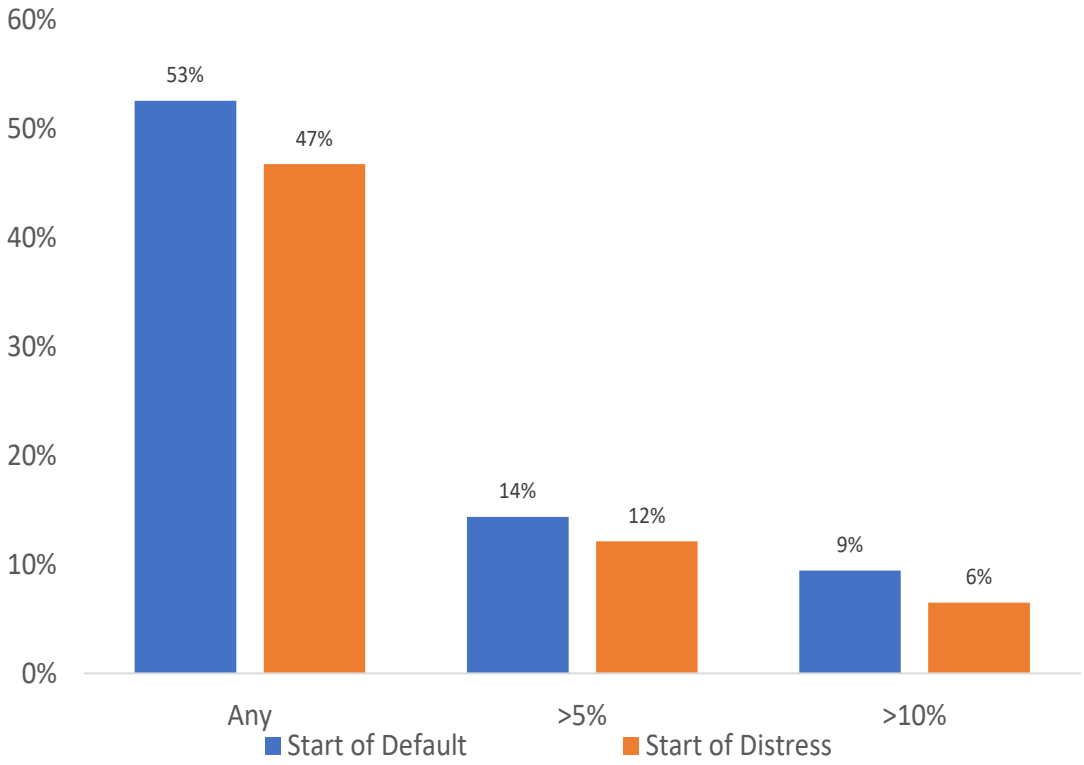
While it is easy to be swayed by the debt-trap diplomacy argument, the question of interest is whether these narratives are supported by existing data. Until recently, this would have been impossible to undertake as a comprehensive dataset of Chinese foreign lending did not exist. In order to answer this question, I explore two empirical issues: the first being whether or not the recent increase of Chinese lending has resulted in higher recorded incidence of distress (or default) and secondly, what are the post default implications when countries restructure their liabilities via versus outside the Paris Club.

Observations of Default and Distress Episodes

The first step in determining whether Chinese lending has led to an observable increase in default and distress incidence is to consider a set of sample statistics. Limiting our sample range from 2000 to 2017 (the years for which data on Chinese lending is available), I have recorded 487 and 1031 unique start of default and start of distress observations, respectively. Out of the 487 default observations, data by Horn, Reinhart, and Trebesch (HRT) found there was any amount of Chinese lending present in 256 of these cases (53%). Controlling for the size of lending by considering the size of Chinese lending in terms of borrower GDP, at the 5- and 10% level, results in 70 and 46 observations, equivalent to 14% and 9%. These numbers decline even more when I consider start of distress episodes. Out of the 1031 unique episodes, HRT found any amount of Chinese lending present in 482 cases (47%); and 125 and 67 cases at the

5% and 10% levels, equivalent to just 12% and 6% of all observations. I can thus conclude that the vast majority of all default and distress episodes that have occurred over the past 20 years either do not involve Chinese lending or only involve Chinese lending at relatively modest levels. Based upon our set of sample statistics, a prima facie conclusion is that an increase in Chinese lending has not been a driver of either default or distress events.

Figure 3. Presence of Chinese Lending in Default and Distress Episodes



Note: Figure 3 shows the presence of Chinse lending in default and distress episodes. While Chinese lending has been found to be present in c. half of all observed default and distress events since 2000, its presence is greatly reduced when controlling for the size of lending. In 14% of default cases, Chinese lending was greater than 5% of the borrowing country's GDP (12% for distress episodes) and only 9% when lending was greater than 10% of the borrowing country's GDP (6% for distress episodes).
Source: Dielmann Default Data; Horn, Reinhart, and Trebesch 2019.

Predicting Default

In order to draw inference about how an increase in Chinese lending has affected the outcomes of debtor countries, my first step is to identify the types of variables that have historically led to incidence of default or distress (DD events). In order to properly identify which variables serve as predictors of DD events, I constructed a dataset of sovereign defaults that could be coded as 0 or 1 dummies for each CountryYear observation in which a DD event occurred. This resulted in an immediate impediment; while there does exist a significant literature on sovereign defaults, there are relatively few publicly available datasets that record these events. Furthermore, this process is challenged by the fact that the existing datasets have vastly different coverage criteria, including country, time, and creditor differences. In order to create a single dataset to record incidence of DD events regarding all creditors, I compiled various different data sources to create a novel dataset that attempts to capture all incidence of sovereign default within the period of 1970 to 2020. This dataset includes observations of private Eurobond defaults via the Monthly Default and Restructuring Dataset (Trebesch and Asonuma 2020), Global Crisis Data (Reinhart et al. n.d.), Moody's Default and Recovery Dataset (2020), Fitch's Sovereign Transition and Default Study (2020), a list of Eurobond defaults occurring in 2020 by Culverhouse (2020), the IMF's Monitoring of Fund Arrangements database (MONA), and a list of stress episodes presented in the appendices of the IMF's most recent MAC DSA Review (2021c).[32]

[32] For a list of sources on sovereign default, see Abbas and Rogoff (2019).

I combined these datasets with the newly released Bank of Canada & Bank of England (BoC/BoE) Sovereign Default Database (Beers and Leon-Manlagnit 2019). This dataset is unique in that instead of expressly capturing incidents of default, it contains data on debtor countries' total arrears broken down by creditor group. In order to translate this data to CountryYear observations of default, I have coded observations as being true in years in which total arrears increased from 0 to any positive value or total arrears more than doubled over the previous year. The first rule is likely quite intuitive in that a default should be recorded when a country begins to run arrears, i.e., legally obligated payments were missed and thus a default occurred. The latter rule, regarding the doubling over previous year's arrears, is likely less intuitive. The reason that this has been coded as such is to capture new arrears that result from a new observation of missed payment. When considering the dataset, it is quite clear that once a country begins to run arrears, they are likely to remain in arrears for a number of years until a resolution can be found and the arrears can be cleared. Thus, each year in which arrears are present should not be considered a new and unique episode of default. If, however, I observe a non-zero amount of arrears that continue for a number of years and then suddenly increase, in this case by a factor of 2 or greater,[33] this is considered to be a new and unique default observation (controlled for with 2-year lag of no default observations).

[33] The factor of 2X was chosen to capture non-insignificant increases of arrears scaled to the existing level of arrears. This criterion can easily be modified and will be discussed in the 'Next Steps' section of the thesis.

The final dataset that was added to complete my Default Dataset (Dielmann Default Data) was to record incidence of Paris Club Treatment. The dataset frequently cited for this data is the 'List of Sovereign Debt Restructurings with the Paris Club 1950-2010' from the work of Das, Papaioannou, and Trebesch (2012). The trouble that I encountered with this dataset is that it was only current through 2010 and thus was largely out of sample when testing against data on Chinese lending from Horn, Reinhart, and Trebesch (2019), with earliest data from 2000. In order to rectify this coverage issue, I created a new dataset of Paris Club treatments based upon individual press release statements that are available on the Paris Club website. This new dataset consists of 469 individual observations covering 98 countries between 1956 and 2020. This creation of a unified default and distress dataset is a significant contribution to the literature of sovereign default. The new dataset covers 193 countries for the period of 1970-2020 and draws from a variety of existing sources that are cited below.

Table 2. Data Sources on Sovereign Default and Distress

Author	Dataset / Source	Country Coverage	Time Coverage	Total D/D Incidence
Asonuma and Trebesch	Monthly Default and Restructuring Database	92 [1,2]	1975-2020	197
Bank of Candada / Bank of England	BoC/BoE Arrears Database	147 [1,2,3]	1960-2019	5365 (o/w 973 Defaults, 4392 Distress)
Das, Papaioannou, Trebesch	List of Sovereign Debt Restructurings with the Paris Club 1950-2010	89 [3]	1950-2010	428
Fitch Ratings	Sovereign 2019 Transition and Default Study	12 [1,2,3]	2001-2019	14
International Monetary Fund	IMF Monitoring of Fund Arrangements (MONA)	103 [1,2,3]	2000-2020	280
International Monetary Fund	2021 MAC DSA Review List	76 [1,2]	1990-2017	482
Moody's Investor Service	Sovereign Default and Recovery Rates	19 [1,2,3]	1983-2019	86
Paris Club	Individual Country Press Releases	98 [2,3]	1956-2021	469
Reinhart and Rogoff	Global Crises Data by Country	70 [1,2,3]	1800-2016	1860 (o/w 491 Defaults, 1369 Distress)
Manual Adjustment [4]		3 [2,3]	2020	3
Merged Dataset			**1970-2020**	**3044 (o/w 1675 Defaults, 2877 Distress)**

Note: A complete list of sources can be found in the references section.
1/ Contains observations on Advanced Market Countries
2/ Contains observations on Emerging Market Countries
3/ Contains observations on Low-Income Countries
4/ Includes Eurobond defaults in 2020 by Argentina, Suriname, and Zambia

Note: Table 2 shows all sources of sovereign default datasets used to create the merged dataset used to generate the binary default and distress dummy variables. A variety of sources were used to create a unified default dataset as individual datasets only include default observations on subsets of creditor or instrument type.

Creating Default and Distress Dummies

With the aforementioned dataset created, I then created 4 dependent binary dummy variables for each of the 3,044 CountryYear observations for whether the Country, in a given year, was in i) a state of default ('In Default') or in ii) a state of distress ('In Distress'). 'In default' dummies were coded as a 1 if there was a default event recorded in: Asonuma and Trebesch's 'Monthly Default and Restructuring

Dataset'; the BoC-Boe Arrears Database (based upon the previously discussed rules); Fitch's 'Sovereign 2019 Transition and Default Study'; Moody's 'Sovereign Default and Recovery Rates' dataset; receiving Paris Club treatment (from my collection of Paris Club press releases); or classified as a default event in Reinhart et al.'s 'Global Crisis' dataset (n.d.); and any manual additions made.[34] Based on these criteria, I have recorded 1,675 unique observations for which a country is default between 1970 and 2020.

The second dummy, In Distress, is similar to In Default; however, it uses a lower hurdle for consideration. Thus, all events that are considered default are, by definition, considered distress events (In Default being a strict subset of In Distress). They can, however, also be triggered through: being in an IMF program; classified as a distress event (rather than default) in Reinhart et al.'s 'Global Crisis' dataset (n.d.); or being included as a distress observation in the IMF MAC DSA Review (2021c). Based on these criteria, I have recorded 2,877 unique observations for which a country is distress between 1970 and 2020.

In addition to wanting to predict if a country will be in default or in distress in a given year, I also needed to test for the onset of both default and distress. I have therefore coded two additional dummy variables titled iii) 'Start of Default' and iv) 'Start of Distress,' where the dummy will be coded as a 1 if the country enters default or distress in a given year and it was neither in distress or in default within the 2 previous years (as with arrears observations, this criterion can easily be modified). Based on

[34] Manual additions include defaults on Eurobond by Argentina, Suriname, and Zambia that occurred in 2020.

these criteria, I have recorded 649 unique observations for which a country enters a new default episode and 816 unique observations for which a country enters a new distress between 1970 and 2020. These additional criteria have been included in order to isolate default and distress events that are truly new onset cases, rather than being the continuation of previous episodes.

Logistic Model

With these binary dummy variables successfully created, I am able to use these observations as the left-hand dependent variables in a logistic regression, as is customary in the sovereign default models (Manasse, Roubini, Schimmelpfennig 2003). Logistic regression models are the most appropriate when regressing upon a binary dependent variable, with other models being ruled out that include linear or log-linear (Poisson) models (those being appropriate for continuous or count variables as the dependent variable, respectively). This model will be further strengthened by employing a 1-Year lag in my independent data (i.e., 2012 GDP Growth as predictor of 2013 Default, etc.) for macroeconomic data only available in annual increments. Ultimately, the aim of these regressive techniques will be to inform us of the likelihood of being in distress (as well as start of distress in later stages). Logistic regression models allow us to calculate the unknown probability, p, for any linear combination of independent variables where Y = 1. In this case, the CountryYear observation is either 'In Distress' or 'Start of Distress'.[35] Such that:

[35] The full derivation of the logistic model can be found in the Appendix.

$$\text{Logit}(P) = \ln [p(\text{in distress}) / 1 - p(\text{in distress})] = \Sigma\ \beta_j x_j$$

Once the probability, p, values are obtained, I am able to test the total predictive power of my model using the Area under the Receiver Operating Characteristic curve (AUC), which will be discussed in greater detail throughout this chapter.

Model Specifications

Using a dataset of 193 countries, spanning 2000 to 2017, I have 2,717 CountryYear observations, resulting in a balanced panel. This allows me to regress a host of continuous independent variables upon my dependent dummy variable of choice (i-iv). Independent variables will serve two goals, the first being to determine which factors are relevant in predicting distress or default episodes, and secondly, to serve as control variables when attempting to determine the net effect that independent variables have upon recorded incidents of distress or default. To select baseline control variables, I was guided by earlier work on early warning models for sovereign default, in particular the work of Manasse, Roubini, and Schimmelpfennig (2003), Borensztein et al. (2000), Review of the Debt Sustainability Framework for Low Income Countries (IMF 2017), and Review of The Debt Sustainability Framework For Market Access Countries (IMF 2021c), to select variables that fulfil a two-pronged goal, the first being that they show statistical significance in the logistic regression model and the second being to increase the total predictive power of the model as measured by the Area Under the Receiver Operating Characteristic Curve. The explanatory variables can be broadly classified as macroeconomic, financial, and development indicators. Where macroeconomic indicators include measures of a country's: current account balance, debt to GDP ratio,

real GDP growth, as well as the log of debt owed to China and debt owed to China as a percent of the borrowing country's GDP (for the regression models in which I include Chinese lending). Financial indicators include measures of a country's: foreign currency reserves, months of import cover (as defined by total FX reserves over average import volumes in US$), and the average 6-month LIBOR rate. Development indicators include measures of a country's: GDP per capita (as measured in PPP$), percent of eligible children that are enrolled in primary school, and the average expected life expectancy (measured at birth). Additionally, I employ a host of control variables, which include: a dummy variable to measure whether the country has experienced previous distress, a dummy variable if the country was in distress one year prior, as well as country and year dummy variables that are used in fixed, random, and mixed effects models. A full list of independent variables is shown below:

Table 3. List of Intendent Control Variables used in Logistic Regression Models

VARIABLE	Description	Source
Previous Distress	Generated dummy variable that is coded as equal to 1 if the country has experienced an episode of previous distress and equal to 0 if they have not (this variable will be equal to 0 until a distress event is observed, subsequently, it will remain equal to 1 for all remaining years)	Generated from Merged Default Database
In Distress (1 year lag)	Generated dummy variable that is coded as a 1-year lag of whether or not the country is already in a state of distress	Generated from Merged Default Database
Current Acct. Bal (1 year lag)	1-year lag of the country's current account balance in percent of GDP. To control for a county's measure of exports and imports	IMF WEO
Ln of Debt to GDP (1 year lag)	Log of the countries debt to GDP on a 1-year lag, to measure the percentage change in debt to GDP. To control for a country's total debt stock, normalized relative to GDP.	IMF WEO
GDP Growth, % (1 year lag)	1-year lag of the country's real GDP growth (measured in national currency, constant prices). To control for a country's change in total economic output.	IMF WEO
GDP Per Capita, PPP (1 year lag)	1-year lag of the Country's per capita GDP in Purchasing Power Parity dollars. To control for a country's total economic output, relative to per capita output measured in PPP dollars.	IMF WEO
Ln Total Reserves, USD (1 year lag)	Log of Total Reserves (including gold). To control for a country's liquid assets that can be used to repay debts.	IMF WEO
Import Cover, Months (1 year lag)	1-year lag of Months of Import Cover (Total Reserves (incl. gold) / avg. monthly import volume). To control for a country's liquiad assets that can be used to repay debts normalized relative to size of average monthly	IMF WEO
6-Month Libor	6-Month Libor. To control for changes in global lending rates.	Federal Reserve Bank of St. Louis
Unemployment, %	Unemployment rate in percent of GDP. To control for general health of the economy.	UN International Labor Organization
Primary School Enrollment, %	Percent of eligible children enrolled in primary school. Control variable to proxy level of country development	World Bank WDI
Life Expectancy at Birth	Expected Life Expectancy at Birth. Control variable to proxy level of country development.	World Bank WDI
Country	Dummy variable to control for country specific fixed effects. Output is not presented in regression tables for brevity.	Generated
Year	Dummy variable to control for year specific fixed effects. Output is not presented in regression tables for brevity.	Generated
Ln of Debt to China, USD (1 year lag)	Log of Debt owed to China by borrower country on a 1-year lag, in USD. To control for changes in debt owed to China.	Horn, Reinhart, and Trebesch
Debt to China, % GDP (1 year lag)	Debt owed to China by borrower country in percent of GDP on a 1-year lag. To control for debt owed to China normalized relative to borrower country's GDP.	Horn, Reinhart, and Trebesch

Note: Table 3 lists all independent and control variables used in the logistic regression models as well as a description of their role and source.

Given the structure of the logistic model and the chosen independent variables, the four regression models are defined as follows:

Testing 'In Distress' against independent variables without Chinese Lending:

$$\text{Logit}(P) = \ln [p(\text{in distress}) / 1 - p(\text{in distress})] = \Sigma\, \beta_j\, \text{PreviousDistress}_j + \beta_j\text{LagInDistress}_j + \beta_j\text{LagCABalance}_j + \beta_j\text{LnDebttoGDP}_j + \beta_j\text{LagGDPGrowth}_j + \beta_j\text{LagGDPperCapita}_j + \beta_j\text{LnTotalReserves}_j + \beta_j\text{LagImportCover}_j + \beta_j\text{6-MonthLIBOR}_j + \beta_j\text{Unemployment\%}_j + \beta_j\text{PrimarySchoolEnrollment\%}_j + \beta_j\text{LifeExpectancy}_j$$

Testing 'In Distress' against independent variables with Chinese Lending:

$$\text{Logit}(P) = \ln [p(\text{in distress}) / 1 - p(\text{in distress})] = \Sigma\, \beta_j\, \text{PreviousDistress}_j + \beta_j\text{LagInDistress}_j + \beta_j\text{LagCABalance}_j + \beta_j\text{LnDebttoGDP}_j + \beta_j\text{LagGDPGrowth}_j + \beta_j\text{LagGDPperCapita}_j + \beta_j\text{LnTotalReserves}_j + \beta_j\text{LagImportCover}_j + \beta_j\text{6-MonthLIBOR}_j + \beta_j\text{Unemployment\%}_j + \beta_j\text{PrimarySchoolEnrollment\%}_j + \beta_j\text{LifeExpectancy}_j + \beta\text{jLagLnDebttoChina}_j + \beta_j\text{LagDebttoChina\%GDP}_j$$

Testing 'Start of Distress' against independent variables without Chinese Lending:

$$\text{Logit}(P) = \ln [p(\text{start of distress}) / 1 - p(\text{start of distress})] = \Sigma\, \beta_j\, \text{PreviousDistress}_j + \beta_j\text{LagCABalance}_j + \beta_j\text{LnDebttoGDP}_j + \beta_j\text{LagGDPGrowth}_j + \beta_j\text{LagGDPperCapita}_j + \beta_j\text{LnTotalReserves}_j + \beta_j\text{LagImportCover}_j + \beta_j\text{6-MonthLIBOR}_j + \beta_j\text{Unemployment\%}_j + \beta_j\text{PrimarySchoolEnrollment\%}_j + \beta_j\text{LifeExpectancy}_j$$

Testing 'Start of Distress' against independent variables with Chinese Lending:

$$\text{Logit}(P) = \ln [p(\text{start of distress}) / 1 - p(\text{start of distress})] = \Sigma\, \beta_j\, \text{PreviousDistress}_j + \beta_j\text{LagCABalance}_j + \beta_j\text{LnDebttoGDP}_j + \beta_j\text{LagGDPGrowth}_j + \beta_j\text{LagGDPperCapita}_j + \beta_j\text{LnTotalReserves}_j + \beta_j\text{LagImportCover}_j + \beta_j\text{6-MonthLIBOR}_j + \beta_j\text{Unemployment\%}_j + \beta_j\text{PrimarySchoolEnrollment\%}_j + \beta_j\text{LifeExpectancy}_j + \beta\text{jLagLnDebttoChina}_j + \beta_j\text{LagDebttoChina\%GDP}_j$$

The first stage model (i) is simply to run a pooled logistic regression of a series of independent variables that have been found to be statistically significant against the binary dependent variable ii. In Distress. The regression output is shown below:

Figure 4. Logistic Regression Models w/ Effects, w/ FE, w/ RE, w/ ME Against 'In Distress'

	Pooled Logit	Fixed Effects	Random Effects	Mixed Effects
Model	(1)	(2)	(3)	(4)
VARIABLES	In Distress	In Distress	In Distress	In Distress
Previous Distress	1.599***	1.116*	1.788***	1.860***
	(0.268)	(0.653)	(0.325)	(0.344)
In Distress (1 year lag)	1.507***	0.802***	1.221***	1.149***
	(0.094)	(0.102)	(0.107)	(0.113)
Current Acct. Bal (1 year lag)	-0.002	-0.014	-0.005	-0.000
	(0.006)	(0.008)	(0.006)	(0.006)
Ln of Debt to GDP (1 year lag)	0.208***	0.033	0.221**	0.470***
	(0.077)	(0.142)	(0.098)	(0.110)
GDP Growth, % (1 year lag)	-0.014	-0.027*	-0.018	-0.023
	(0.012)	(0.016)	(0.014)	(0.015)
GDP Per Capita, PPP (1 year lag)	-0.0000139***	0.00000691	-0.0000146**	-0.0000178**
	(0.000)	(0.000)	(0.000)	(0.000)
Ln Total Reserves, USD (1 year lag)	0.100***	0.095	0.124***	0.116**
	(0.030)	(0.124)	(0.043)	(0.047)
Import Cover, Months (1 year lag)	-0.069***	-0.127***	-0.093***	-0.092***
	(0.019)	(0.043)	(0.024)	(0.026)
6-Month Libor	-0.007	-0.055*	-0.011	0.687***
	(0.023)	(0.032)	(0.025)	(0.186)
Unemployment, %	0.016**	0.099***	0.030***	0.032***
	(0.007)	(0.026)	(0.011)	(0.012)
Primary School Enrollment, %	0.007**	0.013*	0.010**	0.012**
	(0.004)	(0.007)	(0.005)	(0.005)
Life Expectancy at Birth	-0.012	-0.091***	-0.021*	-0.015
	(0.008)	(0.030)	(0.011)	(0.012)
Constant	-5.324***		-5.680***	-10.863***
	(0.875)		(1.205)	(1.626)
Observations	2,717	2,367	2,717	2,717
Number of Countries	155	128	155	155
Country FE	No	Yes	Yes	Yes
Year FE	No	No	No	Yes
Random Effects	No	No	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Figure 4 shows the logistic regression output of the pooled, fixed, random, and mixed effects models against the CountryYear observation being in distress.

The later stage models control for fixed effects, random, and mixed effects. Fixed effect models will control for fixed, non-random characteristics of observations, in this case individual (country) specific characteristics. Random effects models will control for unobserved heterogeneity between groups that might be present as well as fixed (country) effects based on the specification of my panel. In addition to fixed and random effects models, I have also specified a mixed effects model, which controls for random effects (which include country fixed effects) as well as adding a time dummy variable (year) to control for increased likelihood of observing distress events occurring within given years.[36] It is important to note that fixed effects models only include observations that observe variance in the dependent variables (i.e., countries that are observed to be both in distress and not in distress within the sample period). This results in 350 observations, representing 7 Countries, being dropped as a result of not experiencing a distress incident (i.e., being 'In Distress') between 1970 and 2020.

Assessing Total Predictive Power of Models Using the Area under the Receiver Operating Characteristic Curve

In order to gauge the true predictive power of my models, I employ a technique known as the Area under the Receiver Operating Characteristic Curve (AUC). The aim of the AUC is to test for the model's ability to discriminate between the likelihood of achieving a positive outcome, Y = 1, vs a negative outcome, Y = 0, of the predicted variable Yhat, by measuring the total area under the Receiver Operating Characteristic

[36] Time dummy variables are included in mixed effects models, however, the output has been removed from regression output tables as a matter of presentation.

(ROC) curve. While techniques such as Noise-to-Signal[37] ratios aim to calibrate a model's cutoff point to minimize the sum of Type 1 and Type 2 errors, the AUC considers the model's accuracy by measuring the rate of observed 'true positives' and 'true negatives' at each cutoff point continuously between 0% and 100% (Hosmer and Lemeshow 2000). This is done by measuring both the true positive rate of observations ('sensitivity') and the true negative rate of observations ('1 - Specificity') of the model as defined by the following formulas:

Equation 1. Calculation of the True Positive and False Positive Rates

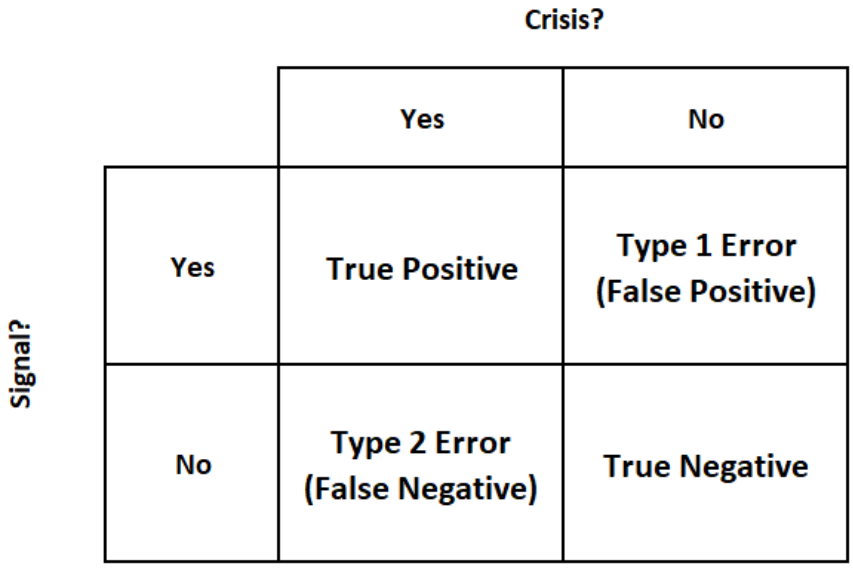
$$\text{True Positive Rate} = \text{Sensitivity} = \frac{\text{\# of True Positive Observations}}{(\text{\# of True Positive Observations} + \text{\# of False Negative Observations})}$$

$$\text{False Positive Rate} = \text{1 - Specificity} = \frac{\text{\# of False Positive Observations}}{(\text{\# of False Positive Observations} + \text{\# of True Negative Observations})}$$

Sensitivity refers to the true positive rate and specificity refers to the true negative rate. To put this more succinctly, "sensitivity refers the probability of true showing up true and specificity to the probability of false showing up false. Sensitivity and specificity are usually expressed in percentage" (Sharma, Yadav, and Sharma 2009), and can be graphically represented in what is known as a 'confusion matrix' as shown below:

[37] For a detailed discussion of the Noise-to-Signal ratio, see Aldasoro, Borio, and Drehmann (2018).

Figure 5. Four Quadrants of AUC Confusion Matrix

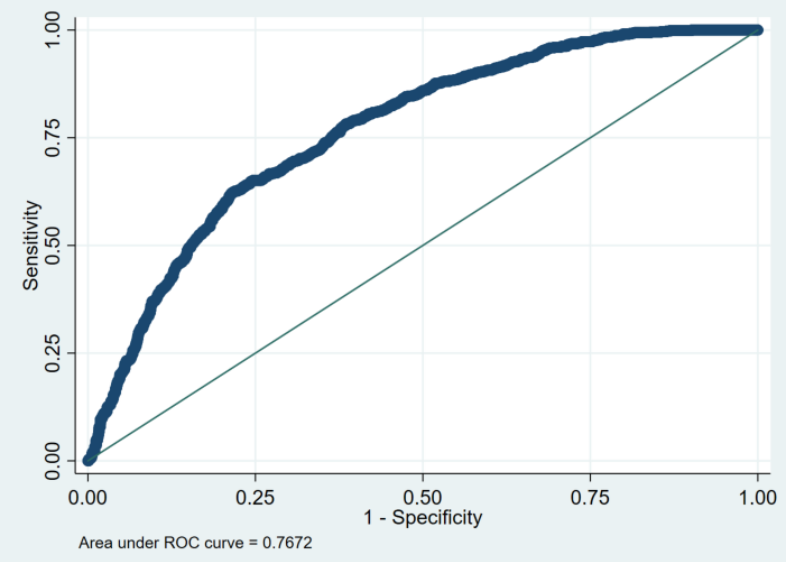


Note: Figure 5 shows the 'confusion matrix' used to generate the Area Under the Receiver Operating Characteristic Curve. Any predictive model will generate one of four possible outcomes: correctly predicting a true positive event (correctly predicting a positive event), a true negative event (correctly predicting a non-event), a type 1 error (incorrectly predicting a positive even in the case of a non-event), and a type 2 error (incorrectly predicting a non-event in the case of a positive event). True positive and true negative observations will be used to calculate the sensitivity and specificity of the AUC.

The next step in calculating the AUC is to plot the ROC curve, where the Y-axis is defined as the sensitivity (that being the true positive rate) and the X-axis defined as the false positive rate, which is equal to (1 – specificity), with both axes ranging from 0 to 1. The area underneath the resulting ROC curve provides a measure of the model's ability to "discriminate between those subjects who experience the outcome of interest versus those who do not" (Hosmer and Lemeshow 2000). This graphically results in an upward sloping 45-degree line for a model with 50% accuracy (one that does not provide any predictive power) and the generated ROC curve superimposed. As the model's ability to discriminate between true positive and false positive observations

increases (thus the model's predictive power increases over 50%), the ROC curve will bend concavely towards the northeasterly corner of the chart (IMF 2021c). The total area under the ROC curve represents a "single scalar value that measures the overall performance of a binary classifier" and thus the total predictive power of the logistic regression model (Melo 2013).

Figure 6. AUC of Pooled Logistic Model



Note: Figure 6 shows the generated AUC curve for the first stage pooled logistic regression model. The value of 0.7672 translates in a total predive power of the model of 76.72%. See Appendix for AUC curves of all regression models.

The AUC of the pooled logistic regression, without controlling for either fixed or random effects results, produced a total area under the curve of 0.7672. Intuitively this result implies that the model currently predicts whether a CountryYear observation will be in distress with c. 77% accuracy, which is considered acceptable discrimination in the literature.[38]

[38] AUC values <= 0.7 and < 0.8 are considered acceptable, values <=0.8 and < 0.9 are considered excellent, and values >= 0.9 are considered outstanding (noting that it is "extremely unusual" to find areas under the curve greater than 0.9; Hosmer and Lemeshow (2000)).

Next, I test the AUC for the additional logistic models that control for fixed, random, and mixed effects. It is important to recall that fixed effects models only include observations that observe variance in the dependent variables and thus result in a smaller number of observations. This decline also contributes to a decrease in total predictive power as measured by the AUC. Thus, they should not be compared against other non-fixed effect models. The results are shown in the table below.

Table 4. Area under ROC Curve (AUC) for Logistic Regression Models for 'In Distress'[39]

Model	# of Observations	Standard Error of AUC	Asymptotic Normal (95% Conf. Interval)		AUC
Pooled Logit	2,717	0.009	0.749	0.786	76.72%
Fixed Effects	2,367	0.012	0.612	0.657	63.42%
Random Effects	2,717	0.009	0.744	0.781	76.29%
Mixed Effects	2,717	0.009	0.771	0.806	78.87%

Note: Table 4 shows the AUC of the pooled logit, fixed, random, and mixed effect models at predicting whether a CountryYear observation will be in distress. The Fixed Effects model shows lower predictive power than other models, in part due to a smaller sample size that results from fixed effects models dropping observations that had zero variance in the dependent variable. The mixed effects model shows the highest predictive power at 78.87%.

The next step is to repeat the above process while also including independent variables on Chinese lending. The aim of doing so will be to test, once properly specified and controlled, whether an increase in Chinese lending leads to an increase in total predictive power of the model; where an increase in predictive power indicates the statistical significance of Chinese lending on countries observing incidents of distress. To do this, I include two observations of Chinse lending from the Chinese Debt Stock

[39] For a discussion on the standard error of the AUC see Hajian-Tilaki and Hanley (2002).

Data by Horn, Reinhart, and Trebesch (HRT; 2019). The first variable that I include is the log of total Chinese debt, in US$, held by the borrowing country, and the second variable is the total amount of Chinese debt as a percent of the borrowing country's GDP. Next, I repeat the earlier exercise with the four model stages. The results are shown below:

Figure 7. Logistic Regression Models w/ Effects, w/ FE, w/ RE, w/ ME w/Chinese Lending Against 'In Distress'

	Pooled Logit	Fixed Effects	Random Effects	Mixed Effects
Model	(5)	(6)	(7)	(8)
VARIABLES	In Distress	In Distress	In Distress	In Distress
Previous Distress	1.612***	1.116*	1.811***	1.876***
	(0.268)	(0.653)	(0.326)	(0.347)
In Distress (1 year lag)	1.498***	0.800***	1.210***	1.134***
	(0.094)	(0.102)	(0.107)	(0.113)
Current Acct. Bal (1 year lag)	-0.003	-0.013	-0.006	-0.001
	(0.006)	(0.008)	(0.006)	(0.006)
Ln of Debt to GDP (1 year lag)	0.198**	0.024	0.199**	0.452***
	(0.077)	(0.143)	(0.098)	(0.110)
GDP Growth, % (1 year lag)	-0.013	-0.027*	-0.017	-0.022
	(0.012)	(0.016)	(0.014)	(0.015)
GDP Per Capita, PPP (1 year lag)	-0.0000166***	0.00000148	-0.0000194***	-0.0000228***
	(0.000)	(0.000)	(0.000)	(0.000)
Ln Total Reserves, USD (1 year lag)	0.106***	0.150	0.143***	0.134***
	(0.031)	(0.132)	(0.045)	(0.049)
Import Cover, Months (1 year lag)	-0.070***	-0.136***	-0.096***	-0.095***
	(0.019)	(0.044)	(0.024)	(0.026)
6-Month Libor	-0.028	-0.061*	-0.037	0.634***
	(0.025)	(0.033)	(0.027)	(0.188)
Unemployment, %	0.014*	0.095***	0.027**	0.030**
	(0.007)	(0.026)	(0.011)	(0.012)
Primary School Enrollment, %	0.007**	0.014**	0.011**	0.012**
	(0.004)	(0.007)	(0.005)	(0.005)
Life Expectancy at Birth	-0.013	-0.084***	-0.022*	-0.018
	(0.008)	(0.030)	(0.012)	(0.013)
Ln of Debt to China, USD (1 year lag)	-0.008	-0.013	-0.014*	-0.018**
	(0.006)	(0.010)	(0.008)	(0.009)
Debt to China, % GDP (1 year lag)	-0.012	0.000	-0.009	-0.001
	(0.010)	(0.013)	(0.011)	(0.011)
Constant	-5.177***		-5.725***	-10.625***
	(0.882)		(1.221)	(1.650)
Observations	2,717	2,367	2,717	2,717
Number of Countries	155	128	155	155
Country FE	No	Yes	Yes	Yes
Year FE	No	No	No	Yes
Random Effects	No	No	Yes	Yes

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Figure 7 shows the logistic regression output of the pooled, fixed, random, and mixed effect models against the CountryYear observation being in distress, with the inclusion of data on Chinese lending. The log of Debt to China is significant at the 10% level in the random effects model and at the 5% level in the mixed effects model, while not significant at the 10% level in either the pooled logit or fixed effects model. Debt to China as a percentage of borrower GDP is not significant at the 10% level in any of the four models.

Based on the regression output, I find that the first new variable, the Log of Debt owed to China in US$, is significant at the 10% level in the random effects model, significant at the 5% level in the mixed effects model, and not significant at a minimum 10% level in either the pooled logistic model or fixed effects model. The second variable, Debt owed to China as a % of the borrower's GDP, was not significant at the 10% level in any of the four models. The full regression output table for 'In Distress' with and without the inclusion of Chinese lending variables is shown in the Appendix.

While the independent observations of Chinese lending are not statistically significant in the majority of the specified models, I also need to determine whether the total predictive power of the models has increased. To do this, I again test for the AUC under these new conditions. The results are shown below:

Table 5. Area under ROC Curve (AUC) for Logistic Regression Models with Chinese Lending for 'In Distress' with and without Chinese Lending

Model	# of Observations	Standard Error of AUC	Asymptotic Normal (95% Conf. Interval)		AUC
Pooled Logit	2,717	0.009	0.749	0.786	76.72%
Pooled Logit with China	2,717	0.009	0.750	0.787	76.85%
Fixed Effects	2,367	0.012	0.612	0.657	63.42%
Fixed Effects with China	2,367	0.012	0.612	0.657	63.44%
Random Effects	2,717	0.009	0.744	0.781	76.29%
Random Effects with China	2,717	0.009	0.746	0.783	76.41%
Mixed Effects	2,717	0.009	0.771	0.806	78.87%
Mixed Effects with China	2,717	0.009	0.771	0.806	78.86%

Note: Table 5 shows the AUCs for the pooled logit, fixed, random, and mixed effect models at predicting whether a CountryYear observation will be in distress. While the addition of Chinese lending does increase the AUC in the pooled, fixed, and random effect models, the increase is negligible. The highest AUC is found in the mixed effect model without Chinese lending.

Based upon the total predictive power of the models, as determined by AUCs, I do not find that the inclusion of variables measuring the size of Chinese lending leads to an increase in total predictive power. Across four models, the inclusion resulted in average improvement of only 0.06%.[40]

Predicting the Start of Distress

Being interested in the onset of a crisis rather than just whether or not a country will be in distress, I repeat the previous steps, however, now regressing upon the binary dummy variable 'Start of Distress' rather than 'In Distress.' The regression output with and without Chinese lending is shown below. (Please note that the full regression output table for 'Start of Distress' with and without the inclusion of Chinese lending variables can be found in the Appendix).

[40] It is important to note that (unless overfitting has occurred) the inclusion of any additional variables is likely to either increase the AUC or leave it unchanged as any coefficient other than 0 will increase the AUC even if it is found to be statistically insignificant.

Figure 8. Logistic Regression Models w/ FE, w/ RE, w/ ME Against 'Start of Distress'

	Pooled Logit	Fixed Effects	Random Effects	Mixed Effects
	(1)	(2)	(3)	(4)
VARIABLES	Start of Distress	Start of Distress	Start of Distress	Start of Distress
Previous Distress?	1.984***	1.370**	2.223***	2.312***
	(0.263)	(0.638)	(0.378)	(0.395)
Current Acct. Bal (1 year lag)	0.002	-0.013	-0.005	0.002
	(0.005)	(0.009)	(0.006)	(0.007)
Ln of Debt to GDP (1 year lag)	0.291***	0.079	0.283***	0.624***
	(0.073)	(0.140)	(0.109)	(0.120)
GDP Growth, % (1 year lag)	-0.034***	-0.038**	-0.036**	-0.038**
	(0.012)	(0.015)	(0.014)	(0.015)
GDP Per Capita, PPP (1 year lag)	-0.00002***	0.00000102	-0.0000186**	-0.0000202**
	(0.000)	(0.000)	(0.000)	(0.000)
Ln Total Reserves, USD (1 year lag)	0.129***	0.133	0.163***	0.132**
	(0.029)	(0.122)	(0.054)	(0.058)
Import Cover, Months (1 year lag)	-0.089***	-0.146***	-0.129***	-0.117***
	(0.018)	(0.042)	(0.027)	(0.029)
6-Month Libor	-0.011	-0.065**	-0.025	0.791***
	(0.022)	(0.032)	(0.026)	(0.186)
Unemployment, %	0.022***	0.126***	0.055***	0.052***
	(0.007)	(0.026)	(0.014)	(0.015)
Primary School Enrollment, %	0.008**	0.014**	0.013**	0.014***
	(0.003)	(0.007)	(0.005)	(0.005)
Life Expectancy at Birth	-0.013*	-0.097***	-0.034**	-0.023
	(0.007)	(0.029)	(0.014)	(0.015)
Constant	-5.790***		-6.000***	-11.920***
	(0.832)		(1.446)	(1.847)
Observations	2,717	2,367	2,717	2,717
Number of Countries	155	128	155	155
Country FE	No	Yes	No	Yes
Year FE	No	Yes	No	Yes
Random Effects	No	No	Yes	Yes

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Figure 8 shows the logistic regression output of the pooled, fixed, random, and mixed effect models against the CountryYear observation being the start year of distress.

Table 6. Area under ROC Curve (AUC) for Logistic Regression Models (without China) for 'Start of Distress'

Model	# of Observations	Standard Error of AUC	Asymptotic Normal (95% Conf. Interval)		AUC
Pooled Logit	2,717	0.010	0.664	0.705	68.44%
Fixed Effects	2,367	0.012	0.576	0.622	59.90%
Random Effects	2,717	0.010	0.663	0.703	68.31%
Mixed Effects	2,717	0.009	0.708	0.746	72.69%

Note: Table 6 shows the AUC of the pooled logit, fixed, random, and mixed effect models at predicting whether a CountryYear observation being the start year of distress. The fixed effects model shows lower predictive power than other models, in part due to a smaller sample size that results from fixed effects models dropping observations that had zero variance in the dependent variable. The mixed effects model shows the highest predive power at 72.69%. In each case, the AUC is lower when predicting the start year of distress than predicting in distress.

Figure 9. Logistic Regression Models w/ FE, w/ RE, w/ ME w/Chinese Lending Against 'Start of Distress'

	Pooled Logit	Fixed Effects	Random Effects	Mixed Effects
	(5)	(6)	(7)	(8)
VARIABLES	Start of Distress	Start of Distress	Start of Distress	Start of Distress
Previous Distress?	1.999***	1.368**	2.248***	2.316***
	(0.263)	(0.638)	(0.378)	(0.397)
Current Acct. Bal (1 year lag)	0.000	-0.013	-0.006	0.001
	(0.005)	(0.009)	(0.006)	(0.007)
Ln of Debt to GDP (1 year lag)	0.277***	0.069	0.251**	0.590***
	(0.073)	(0.141)	(0.109)	(0.120)
GDP Growth, % (1 year lag)	-0.031***	-0.038**	-0.033**	-0.036**
	(0.012)	(0.015)	(0.014)	(0.015)
GDP Per Capita, PPP (1 year lag)	-0.0000234***	-0.00000508	-0.0000258***	-0.0000275***
	(0.000)	(0.000)	(0.000)	(0.000)
Ln Total Reserves, USD (1 year lag)	0.136***	0.195	0.194***	0.159***
	(0.030)	(0.129)	(0.056)	(0.059)
Import Cover, Months (1 year lag)	-0.092***	-0.156***	-0.133***	-0.121***
	(0.018)	(0.043)	(0.028)	(0.029)
6-Month Libor	-0.038	-0.071**	-0.054**	0.723***
	(0.024)	(0.032)	(0.028)	(0.188)
Unemployment, %	0.020***	0.121***	0.050***	0.049***
	(0.007)	(0.026)	(0.014)	(0.015)
Primary School Enrollment, %	0.008**	0.014**	0.013**	0.015***
	(0.003)	(0.007)	(0.005)	(0.006)
Life Expectancy at Birth	-0.014*	-0.089***	-0.032**	-0.025*
	(0.007)	(0.030)	(0.014)	(0.015)
Ln of Debt to China, USD (1 year lag)	-0.010*	-0.014	-0.020**	-0.024***
	(0.006)	(0.010)	(0.008)	(0.009)
Debt to China, % GDP (1 year lag)	-0.015	-0.001	-0.008	0.000
	(0.010)	(0.012)	(0.011)	(0.012)
Constant	-5.596***		-6.355***	-11.711***
	(0.838)		(1.455)	(1.863)
Observations	2,717	2,367	2,717	2,717
Number of Countries	155	128	155	155
Country FE	No	Yes	No	Yes
Year FE	No	Yes	No	Yes
Random Effects	No	No	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Figure 9 shows the logistic regression output of the pooled, fixed, random, and mixed effect models against the CountryYear observation being the start year of distress, with the inclusion of data on Chinese lending. The log of Debt to China is significant at the 5% level in the random effects model and at the 1% level in the mixed effects model, while not significant at the 10% level in either the pooled logit or fixed effects model. Debt to China as a percentage of borrower GDP is not significant at the 10% level in any of the four models.

Based on this regression output, I find that the Log of Debt owed to China in US$ to be significant at the 10% level in the pooled logistic model, the 5% level in the random effects model, at the 1% level in the mixed effects model, and not significant at the 10% level in the fixed effect model. Debt owed to China as a percent of the

borrower's GDP was not significant at the 10% level in any of the four regression models. Testing for the total predictive power of the models, I again find that the inclusion of variables measuring the size of Chinese lending leads to a negligible increase in total predictive power of the models. Across four models, the inclusion resulted in average improvement of only 0.24%.

Table 7. Joint Area under ROC Curve (AUC) for Logistic Regression Models with and without Chinese Lending 'Start of Distress'

Model	# of Observations	Standard Error of AUC	Asymptotic Normal (95% Conf. Interval)		AUC
Pooled Logit	2,717	0.010	0.664	0.705	68.44%
Pooled Logit with China	2,717	0.010	0.667	0.708	68.78%
Fixed Effects	2,367	0.012	0.576	0.622	59.90%
Fixed Effects with China	2,367	0.012	0.577	0.623	59.98%
Random Effects	2,717	0.010	0.663	0.703	68.31%
Random Effects with China	2,717	0.010	0.667	0.708	68.76%
Mixed Effects	2,717	0.009	0.708	0.746	72.69%
Mixed Effects with China	2,717	0.010	0.709	0.747	72.79%

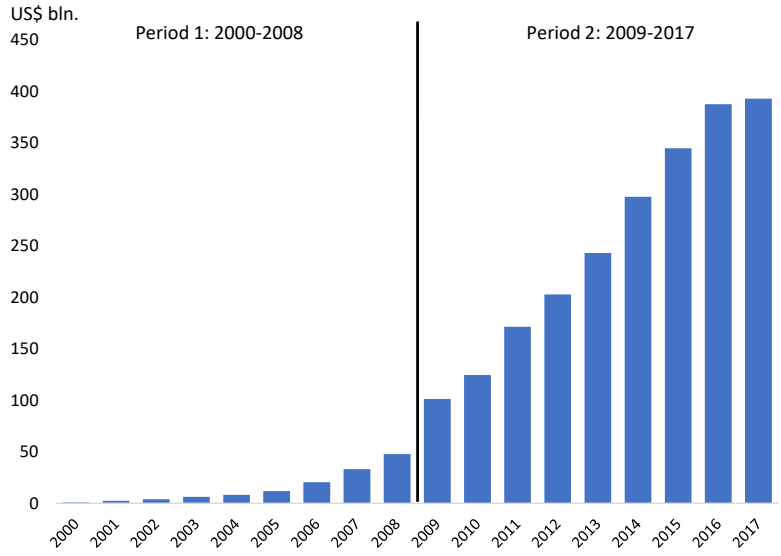
Note: Table 7 shows the AUCs for the pooled logit, fixed, random, and mixed effect models at predicting whether a CountryYear observation being the start year of distress. While the addition of Chinese lending does increase the AUC in all models, the increase is negligible.

Based upon the results of these logistic regression models as well as the AUCs to test for total predictive power, I reject the hypothesis that recent increases in Chinese lending have had a statistically significant effect on the likelihood that countries will experience an onset of distress or be in distress.

Has a Growth in Chinese Lending Over Time Altered the Results?

Based on aforementioned results of the logistic regression models to test for statistical significance of increased Chinese lending on recorded instances of default and distress, I have been unable to determine that they are indeed significant. This, however, leads me to a new question: whether the increase in Chinese lending that has been recorded by Horn, Reinhart, and Trebesch between 2000 and 2017 (2019; see Figure 10) represents a structural break between 'early' and 'later' years.

Figure 10. Total Direct Sovereign Loans Owed to China



Note: Figure 10 shows the annual total amount of direct lending, i.e., loans from Chinese creditors to borrowing countries, in billions of US$. In order to test whether higher lending rates in later years result in different levels of statistical significance, the sample period is split into two periods; Period 1 from 2000 to 2008 and Period 2 from 2009 to 2017.
Source: Horn, Reinhart, and Trebesch (2019).

While the direct sovereign loans owed to China have increased in every year between 2000 and 2017, one can ask whether small increases in 'early' years contribute to likelihood of witnessing a default or distress event as much as the significantly larger increases in debt that we see in 'later' years in nominal terms.

Splitting the sample into two equal time periods, I am left with two distinct periods: Period 1 from 2000 to 2008 and Period 2 from 2009 to 2017. Using 2009 as the start year of Period 2 also conveniently aligns itself with the onset of the Global Financial Crisis.

Repeating the earlier regression models on the now split sample, I find that neither the Log of Debt owed to China nor Debt owed to China as a % of the borrower's GDP was statistically significant at the 10% level in either the pooled logistic, fixed, or random effects models, for either the Pre or Post 2009 sample (8 total models; full regression output can be found in the Appendix), while the Debt owed to China as a % of borrower's GDP was significant at the 10% level in the mixed effects model in the Pre 2009 period only. These findings suggest that neither measure of Chinese lending can be said to be statistically significant when measured against a country being in distress.

The next stage is to again test for the total predictive power of my models for the pre 2009 and post 2009 samples, with and without the inclusion of measures of Chinese lending, using the AUC. The results are shown below:

Table 8. Joint Area under ROC Curve (AUC) for Logistic Regression Models with and without Chinese Lending for 'In Distress'; Pre and Post 2009.

Model	Combined AUC (# Obs.)	Pre 2009 AUC (# Obs.)	Post 2009 AUC (# Obs.)
Pooled Logit	76.72%	78.65%	77.16%
	(2717)	(1458)	(1259)
Pooled Logit with China	76.85%	78.87%	77.25%
	(2717)	(1458)	(1259)
Fixed Effects	63.42%	61.12%	62.45%
	(2367)	(1131)	(949)
Fixed Effects with China	63.44%	61.26%	62.57%
	(2367)	(1131)	(949)
Random Effects	76.29%	78.47%	76.60%
	(2717)	(1458)	(1259)
Random Effects with China	76.41%	78.66%	76.68%
	(2717)	(1458)	(1259)
Mixed Effects	78.87%	80.66%	77.13%
	(2717)	(1458)	(1259)
Mixed Effects with China	78.86%	81.22%	77.26%
	(2717)	(1458)	(1259)

Note: Table 8 shows the AUCs for the pooled logit, fixed, random, and mixed effect models at predicting whether a CountryYear observation will be in distress for Period 1, Period 2, and the total time period. While the AUC does increase when considering sub-periods, as compared to the total time period, the addition of Chinese lending has only a negligible effect on increasing total predictive power of the models.

The total predictive power of the models is marginally improved when dividing the sample into two distinct time periods (comparing from left to right in the previous table; an average increase of 0.88%), with the exception of the Fixed Effects model.[41] These findings suggest that there are potential merits in designing early warning models based

[41] As previously discussed, the Fixed Effects model drops country observations for which there was no variance in the dependent variable, i.e., no observed distress events within the time sample.

on time periods that share common characteristics, or epochs as suggested by Aggarwal (1996) albeit minor. However, if I consider the inclusion of measures of Chinese lending (comparing from top to bottom in the previous table; an average increase of 0.19%), as with our full-time sample, I do not see any significant increases in total predictive power of my models once I control for Chinese lending.

Next, I repeat the previous process, however, now testing against the 'Start of Distress' rather than 'In Distress' and again find that neither Log of Debt owed to China nor Debt owed to China as a percent of the borrower's GDP is statistically significant at the 10% level in any of the four models for the Post 2009 sample (8 total models; full regression output can be found in Appendix). In the Pre 2009 sample, I find that only the Log of Debt owed to China was significant at the 10% level in the mixed effects model, and not significant at the minimum 10% level in any of the other models. Debt owed to China as a % of Borrower's GDP was not significant at the minimum 10% level in any of the four models.

Testing for total predictive power of the models using the AUC, I again find evidence that suggests early warning models could be strengthened through the use of qualified time periods; however, there does not appear to be any significant improvement in total predictive power with the inclusion of measures of Chinese lending (measuring an average increase of 0.14% across all four models).

Table 9. Joint Area under ROC Curve (AUC) for Logistic Regression Models with and without Chinese Lending for 'Start of Distress'; Pre and Post 2009.

Model	Combined AUC (# Obs.)	Pre 2009 AUC (# Obs.)	Post 2009 AUC (# Obs.)
Pooled Logit	68.44%	72.08%	71.04%
	(2717)	(1458)	(1259)
Pooled Logit with China	68.78%	72.35%	71.30%
	(2717)	(1458)	(1259)
Fixed Effects	59.90%	59.50%	62.53%
	(2367)	(1131)	(949)
Fixed Effects with China	59.98%	59.43%	62.54%
	(2367)	(1131)	(949)
Random Effects	68.31%	70.98%	70.84%
	(2717)	(1458)	(1259)
Random Effects with China	68.76%	71.38%	71.02%
	(2717)	(1458)	(1259)
Mixed Effects	72.69%	74.31%	72.49%
	(2717)	(1458)	(1259)
Mixed Effects with China	72.79%	74.88%	72.61%
	(2717)	(1458)	(1259)

Note: Table 9 shows the AUCs for the pooled logit, fixed, random, and mixed effect models at predicting whether a CountryYear observation being the start year of distress for Period 1, Period 2, and the total time period. While the AUC does increase when considering sub-periods, as compared to the total time period, the addition of Chinese lending has only a negligible effect on increasing total predative power of the models.

The Importance of Interest Rates

It is important to note that the sample period for which I have data on Chinese lending, that being the years from 2000 to 2017, coincides with a period of historically low interest rates. It is therefore a reasonable assumption that the current low interest rate environment might be a contributing factor in a low recorded number of distress

incidents caused by an increase in Chinese lending. This assumption would be based upon both the impact that higher rates have on the increased cost associated with rolling-over existing debt that is falling due (i.e., using the proceeds of a new bond issue to repay the liabilities that are maturing), as well as the endogenous component of the r-g differential of a country's debt dynamics. This differential posits that, holding other factors constant, a country's debt to GDP ratio in period T+1 will increase by the differential, i.e., real interest rates minus its real GDP growth rate, multiplied by its debt to GDP ratio in period T0. As interest rates increase, the cost of serving ~~its~~ debt becomes more expensive, requiring increases in debt issuance to cover these additional interest costs, ultimately contributing to a higher debt stock.[42]

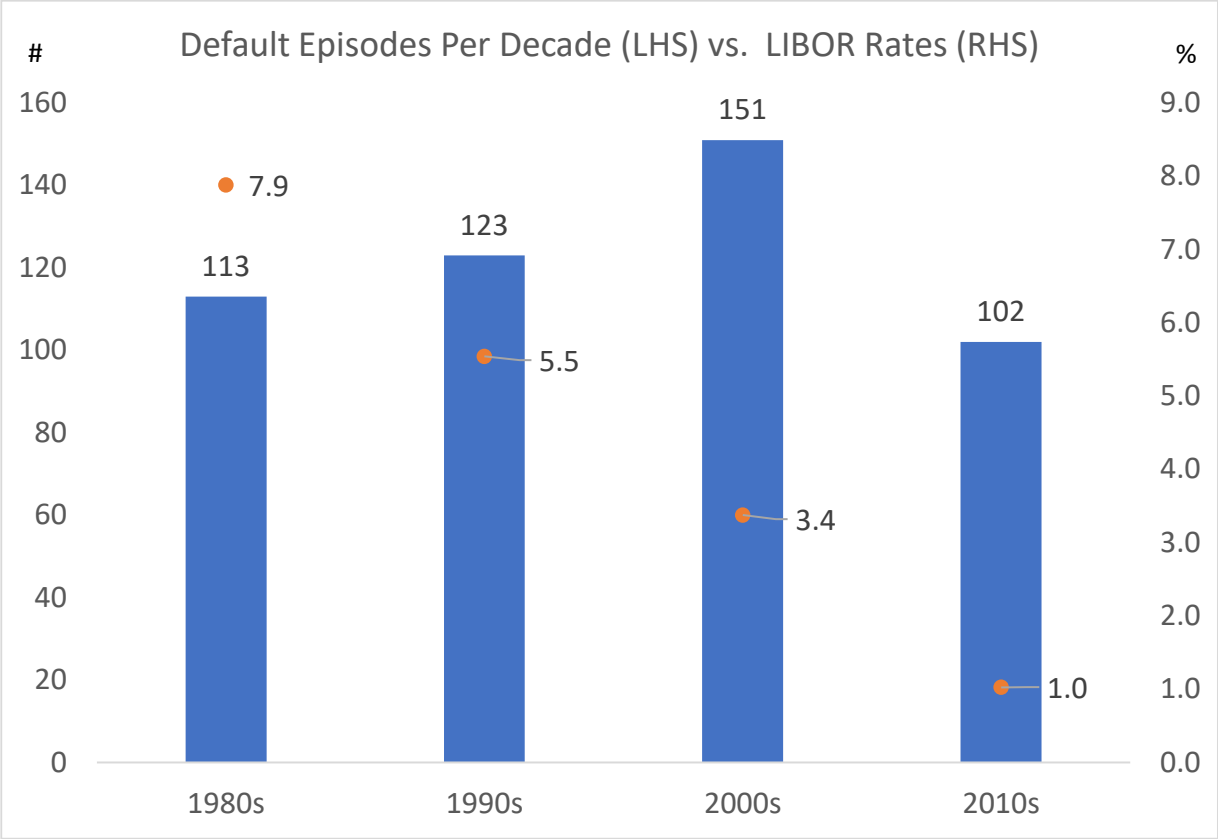
In order to answer the question as to whether a low number of default and distress episodes can be attributed to the current interest rate environment, I have tested the impact of interest rates in two different ways, the first being a set of simple sample statistics that show the total number of default episodes that occurred within a decade vs. the average LIBOR rates during these periods, and the second is to test the marginal effect that LIBOR rates have on whether a country witnesses the start of a distress episode.

When considering the sample statistics, I find that despite a period of falling LIBOR rates, on average per decade, since their introduction in 1986, the number of default episodes actually increased from the 1980s to the 2000s, recording 113 events in the 1980s, 123 events in the 1990s, and 151 events in the 2000s. It was only during

[42] For a detailed discussion on debt dynamics and the impact of the r-g differential on debt to GDP ratios, see IMF 2013 Annex I. Debt Dynamics.

the 2010s, that the number of default episodes actually decreased to 102 unique events, suggesting a weak relationship between rates and the number of observed default episodes. These figures can be seen below in Figure 12.

Figure 11. Number of Unique Default Episodes per Decade vs. Change in Average LIBOR Rates



Note: Figure 11 shows the total number of unique sovereign default events occurring per decade compared to the average LIBOR rates within that period. Despite LIBOR rates having fallen in each decade since the 1980s, total default episodes actually increased in the 1990s and 2000s. It was only in the 2010s that a decline in sovereign default episodes coincided with a decline in LIBOR rates.
Source: Dielmann Default Data; ICE Benchmark Administration Limited (IBA)

The second test that I conducted to determine the relationship between interest rates and episodes of sovereign distress was to generate a marginal effects graph

between LIBOR rates and the onset of distress events. By holding all the other independent variables at their mean values within the sample period, I was able to test the marginal effect that LIBOR rates have on whether a country observes the start of a distress event, at various levels of rates. I have tested the marginal effect at four different levels of LIBOR rates, those being at 0.33% (which represents the lowest annual LIBOR rate in the 2000-2017 sample), 2.13% (the mean annual LIBOR rate for the 2000-2017 sample), 6.66% (the highest annual LIBOR rate for the 2000-2017 sample), and 9.23% (the highest total annual LIBOR rate since introduction of LIBOR in 1986, which occurred in 1989).

Figure 12. Marginal Effect Graph for LIBOR Against 'In Distress'

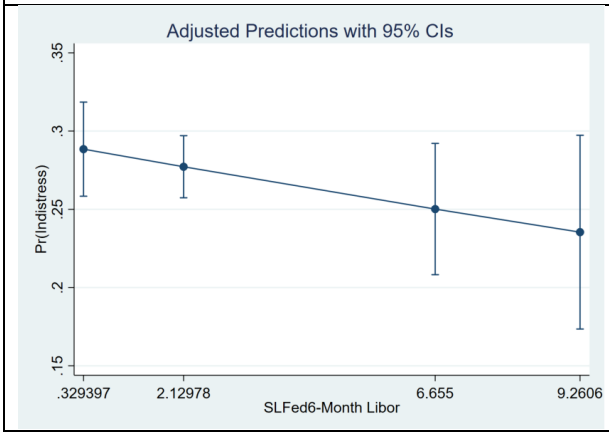
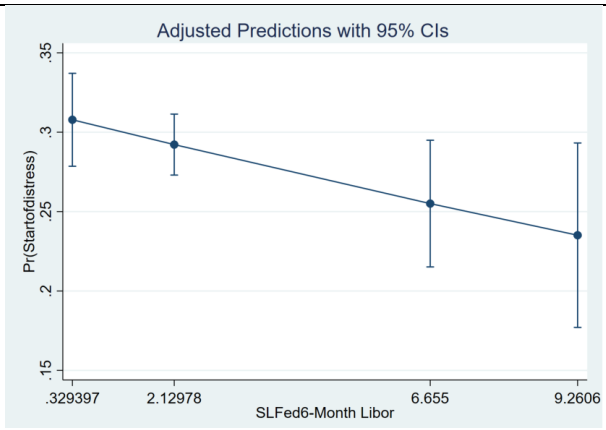


Figure 13. Marginal Effect Graph for LIBOR Against 'Start of Distress'



Note: Figures 12 & 13 show the marginal effect on the probability that countries are either in distress or witness a start of distress episode in a given year. In both cases, the marginal effect of LIBOR rates on a country being in distress or witnessing the start of a distress episode are negative, suggesting that increases in LIBOR rates are unlikely to result in increased distress episodes.
Source: Dielmann Default Data; ICE Benchmark Administration Limited (IBA)

Although, as already discussed, a country's debt dynamics are negatively affected by increasing rates, the empirical analysis of the data over the past 35 years

suggests that rates are unlikely to have a meaningful impact on default episodes in a systematic way. When considering the marginal effects graph, not only do I find that the likelihood of witnessing a start of distress episodes actually decreases with each successive increase in rates, but based upon their 95% confidence interval, they are not distinguishable from one another. This suggests that the change in probability of a new distress episode based upon changes in LIBOR Rates is not statistically different from zero. While these findings are counter-intuitive, they could be explained in two primary ways, the first being that countries that default appear to do so based on unique challenges faced by characteristics by the defaulting country at that point in time rather than global factors affecting all countries. A second reason that could explain these findings is that only a subset of a country's total borrowing will be done at commercial rates, i.e., using the types of instruments that would be particularly sensitive to rate changes. While advanced market economies are likely to see the majority of their borrowing done on a commercial basis, these countries are also the most capable of avoiding a default due to their pre-existing levels of wealth. Low-income and emerging market economies that are historically more prone to witnessing default episodes will likely have a much smaller proportion of their total borrowing on commercial terms.

Both of these findings suggest that the current low interest rate environment has not served as a significant driver in the findings that Chinese lending has not systematically contributed to higher levels of distress episodes.

Stylized Facts from Regression Output

Ultimately, the results do not support the notion that an increase in Chinese lending has led to an increase in the number of observed distress incidents, neither measured as a CountryYear observation being in distress, nor observing the start of a distress event. In order to reach these findings, I have used four separate logistic regression models, including a pooled logistic model as well as fixed, random, and mixed effects models. In each of these cases, the addition of Chinse lending variables does not result in any meaningful increase in the total predictive power of the models as measured by statistical significance of independent covariates or through the AUC. Repeating this exercise to include a structural break to control for a change in Chinese lending patterns occurring in 2009 also does not result in any recorded significance of independent covariates at the 10% level in any of the models. Thus, I conclude that the observed increase in Chinese lending that has occurred over the past two decades has not led to a systematic increase in distress observations.

III. Why the Paris Club – Do Empirical Observations Suggest That Countries That Receive Paris Club Treatment Witness Materially Better Economic Outcomes Than Those That Do Not?

The second empirical question that I intend to answer is whether or not countries that receive treatment from the Paris Club witness statistically improved macroeconomic outcomes compared to those that do not. While it may seem obvious that countries that receive significant debt relief, in conjunction with an IMF lending program, should witness improved outcomes, it is not a question that I have seen addressed in the literature on sovereign defaults. This partly relates to the aforementioned discussion on lack of data availability, both with respect to Paris Club treatments and any pre-existing dataset on sovereign defaults. My dataset contains this data, allows for the separation of event types, and thus makes analysis on economic outcomes possible.

With the necessary data collected, the first step in conducting this analysis required the separation of default incidents into default episodes that were triggered as a result of Paris Club (PC) treatment and those that resulted from non-Paris Club (non-PC) treatment. Data on non-PC defaults required an additional step, which was to ensure that the event was fully independent of any PC involvement. In other words, to ensure that I only consider the isolated impact of a non-PC outcome (thus isolating the treatment effect of PC treatment in comparison), I control for there not being any PC treatment that occurred within +/– 2 years of the recorded default.

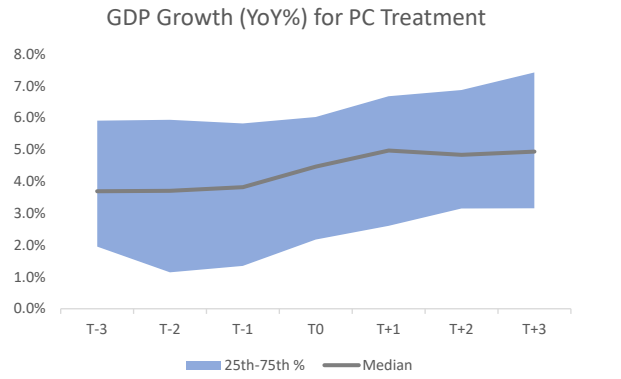
In the absence of being able to randomize selection of treatment, I am employing a difference-in-difference design that centers default episodes around Time 0 (T_0), and then considers the path of a host of macroeconomic variables in the three years prior to

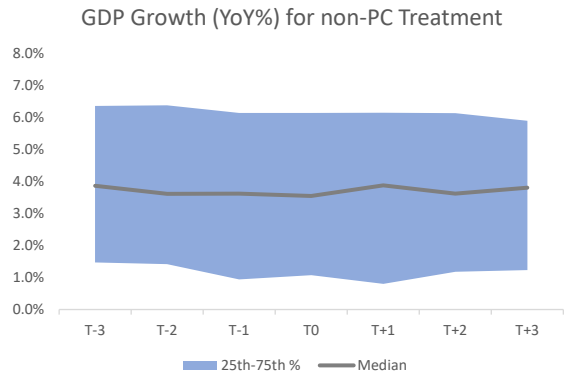
default episode and three years post-default. While this method of examining performance pre and post default centered around T_0 is not unique, I am unaware of prior literature that has focused on demonstrating improved macroeconomic conditions of debtor countries that result from Paris Club treatment. Just as in the discussions above, this is likely due to the lack of available datasets that provide sufficient coverage on default type and allow for the easy separation of events.

It is important to note that there is substantial heterogeneity between these samples, i.e., by definition, countries receiving Paris Club treatment are either classified as low-income or emerging market countries and have a significantly higher debt to GDP ratio prior to treatment (see Figure 17). While it is unlikely that we can ever fully control for the starting differences in selection, the aim of analyzing the treatment effect will always be to try and "distinguish the effects of a treatment from the effects of the conditions under which the treatment is applied" (Przeworksi 2009). This is, at least partially, achieved by conducting a second round of analysis on a third group of countries that likely would have qualified for Paris Club treatment based on their ex-ante debt to GDP levels, yet were ineligible to receive treatment as they were not classified as a low-income or emerging market (e.g., Greece 2012) or were not in an IMF program (e.g., Mozambique 2015). The observations within this third group of cases were selected based on having a debt to GDP level that was equal to or higher than the 25^{th} percentile of cases that did receive Paris Club treatment in period T_{-1}., which meant having a debt to GDP ratio in excess of 52%.

a. Effect of Paris Club Treatment on Real GDP Growth

Figure 14. Real GDP Growth, Pre and Post Default, Paris Club vs non-Paris Club Treatment





Average Cumulative Growth, T_0 to T_3: +15.62%	Average Cumulative Growth, T_0 to T_3: +10.97%

Note: Figure 14 shows the change in countries' real GDP growth between T_{-3} and T_3 for those receiving Paris Club treatment vs. those that did not. On average, countries that receive Paris Club treatment grew at higher rates than those that did not.

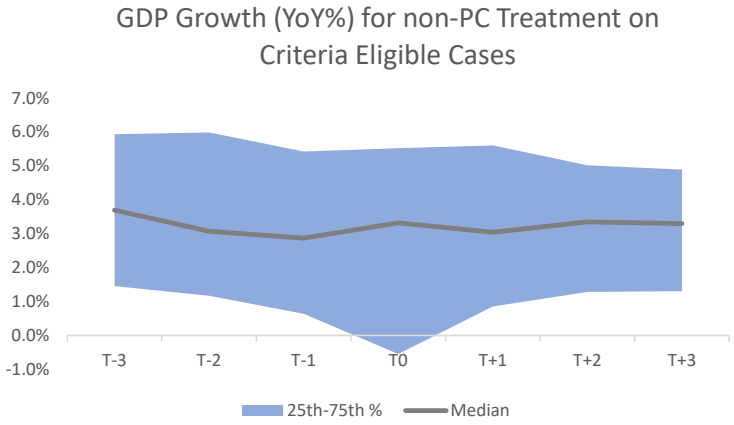
From Figure 15, one can see that on average, GDP in countries that received Paris Club treatment grew at a higher rate than those countries that did not. The average cumulative growth of the period from T_0 to T_3 was 15.62% for countries that received Paris Club Treatment compared to 10.97% for those that did not. Furthermore, means and variance tests confirm at the 1% level of significance that these outcomes are indeed distinct from each other.[43][44]

This overall improvement includes several components: a reduction in debt overhang, improved perception of the country's prospects following a coordinated outcome with bilateral creditors, and potentially regaining market access, thus further

[43] Note that charts with this chapter show the median line of underlying data. This line will not be perfectly centered between 25th and 75th percentile bands unless the underlying data contains zero skew.
[44] Full means and variance tests for each indicator can be found in the Appendix.

reducing borrowing costs. There are a number of underlying reasons. One is that the aim of restoring debt sustainability of a country requires a strong growth plan as a necessary component. As found by Kumar and Woo (2010), the inverse relationship between initial debt levels and growth suggests that the debt reduction as part of the Paris Club treatment translates to higher observed levels of growth. This is partly related to the existing debt overhang being removed, thus freeing up fiscal space that can be shifted towards social spending, as well as an improved investor perception that contributes towards improved economic outcomes. This function might also take place on a micro level as Ong, Theseira, and Ng (2019) note, as reduced debt levels have a beneficial psychological effect on low-income individuals and households, resulting in a subsequent spurt in economic activity. When we consider the change in growth in the criteria-eligible group, that being the group of countries that had ex-ante debt to GDP ratios that would have qualified them to receive treatment, yet did not based upon other selection criteria, we can see that real GDP growth was positive during the period from T_0 to T_3, with an average cumulative growth of 11.73%. Whiel this is a higher figure than recorded in the full non-Paris Club sample, it remains lower than the group of countries that did receive Paris Club Treament.

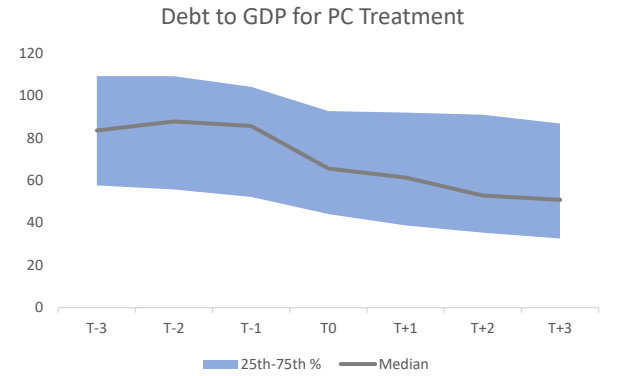
Figure 15. Real GDP Growth, Pre and Post Default, for non-Paris Club Treatment on Criteria Eligible Cases

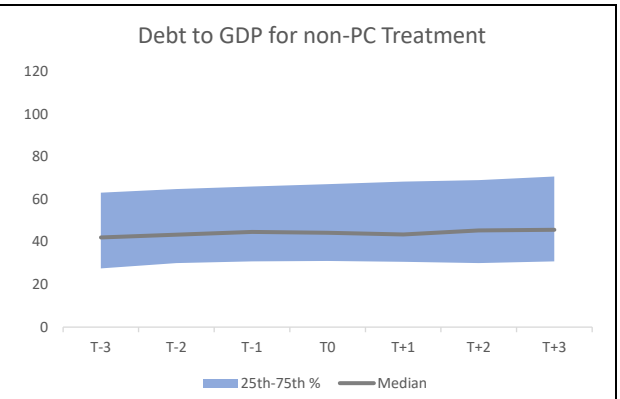


Note: Figure 15 shows the median real GDP growth rate for the criteria-eligible group of countries between T_{-3} and T_3. This group did not receive Paris Club treatment but would have been eligible based on individual debt to GDP levels in year T_{-1}. The cumulative average growth for the criteria-eligible group T_0 and T_3 was 11.73%, higher than the non-Paris Club group but below that of the Paris Club treatment group.

b. Effect of Paris Club Treatment on Debt to GDP

Figure 16. Debt-to-GDP, Pre and Post Default, Paris Club vs non-Paris Club Treatment





Average Cumulative change in Debt to GDP, T_0 to T_3: -17.33%	Average Cumulative change in Debt to GDP, T_0 to T_3: +2.35%

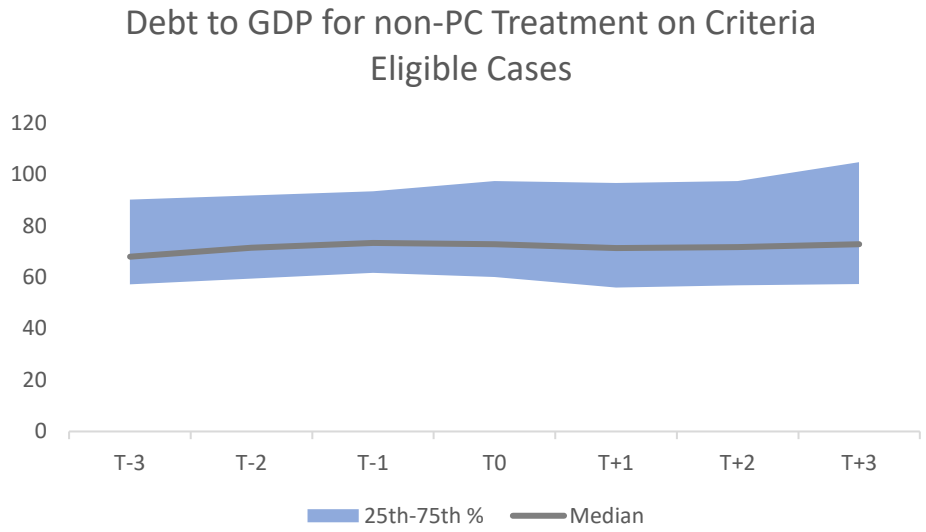
Note: Figure 16 shows the change in countries' debt-to-GDP ratios between T_{-3} and T_3 for those receiving Paris Club treatment vs. those that did not. On average, countries that received Paris Club treatment saw significantly larger declines in debt-to-GDP ratios than those that did not.

Similarly, I find significantly improved outcomes when I consider the effect of Paris Club treatment on a country's debt to GDP. I find that, on average, countries receiving Paris Club treatment witness a 3-year cumulative reduction in their debt to GDP by 17.33%,[45] whereas countries that do not receive Paris Club treatment actually see their debt increase by an average of 2.35%. As the aim of the Paris Club is to offer a package of debt relief to the debtor country, it should be no surprise that receiving Paris Club treatment would result in a reduction in a country's debt stock as well as its debt ratios, a finding also supported by Lang, Mihalyi, and Presbitero (2020). It is interesting, however, that countries that do not receive this treatment observe a continued increase in their debt levels post default (it is important to note that the starting levels of debt for these two groups are very different, c. 85% in year T_{-1} for countries that will receive Paris Club treatment, compared to c. 45% for those that do not[46, 47]). These finding suggest that countries that do not receive Paris Club treatment are also unlikely to receive substantial debt relief through other channels, i.e., haircuts on debt owed to commercial creditors, suggesting that countries receive a benefit through Paris Club treatment. When considering the change in the criteria-eligible group, I again find that the outcomes are more beneficial than we considering the pure non-PC group. Instead of seeing a marginal increase in debt to GDP levels, the criteria-

[45] This decrease grows to 35.70% if I consider a start date of T-1, perhaps suggesting that debt was retroactively reclassified or forgiven.
[46] These are median values.
[47] This raises an important issue regarding the eligibility of countries to receive Paris Club treatment. Additional work should be conducted to control for country specific characteristics that would help isolate the treatment effect of the Paris Club.

eligible group actually shows an average reduction of 5.64% for the period of from T_0 to T_3.

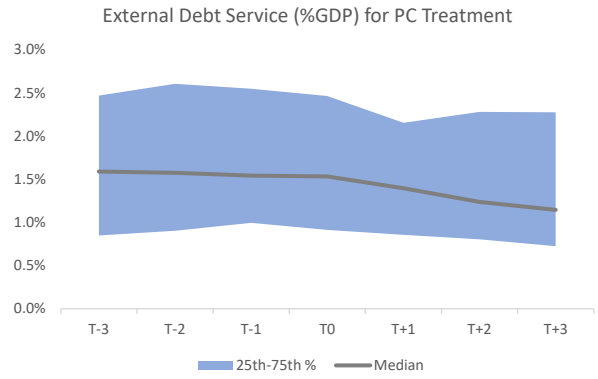
Figure 17. Debt to GDP, Pre and Post Default, for non-Paris Club Treatment on Criteria Eligible Cases

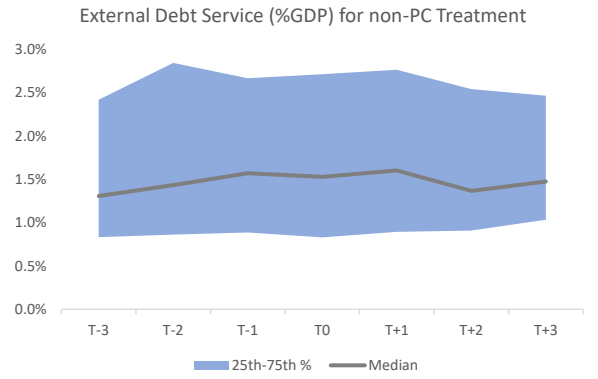


Note: Figure 17 shows the median debt to GDP ratio for the criteria-eligible group of countries between T_{-3} and T_3. This group did not receive Paris Club treatment but would have been eligible based on individual debt to GDP levels in year T_{-1}. The decline in debt to GDP for the criteria-eligible group T_0 and T_3 was 5.64%, higher than the non-Paris Club group but below that of the Paris Club treatment group.

c. Effect of Paris Club Treatment on External Debt Service

Figure 18. External Debt Service, % GDP, Pre and Post Default, Paris Club vs. non-Paris Club Treatment





Average Cumulative External Debt Sevice Paid, %GDP, T_0 to T_3: 7.66%	Average Cumulative External Debt Sevice Paid, %GDP, T_0 to T_3: 8.56%

Note: Figure 18 shows the change in countries' external debt service, as a percent of GDP, between T_{-3} and T_3 for those receiving Paris Club treatment vs. those that did not. On average, countries that received Paris Club treatment observed larger declines in external debt service than those that did not.

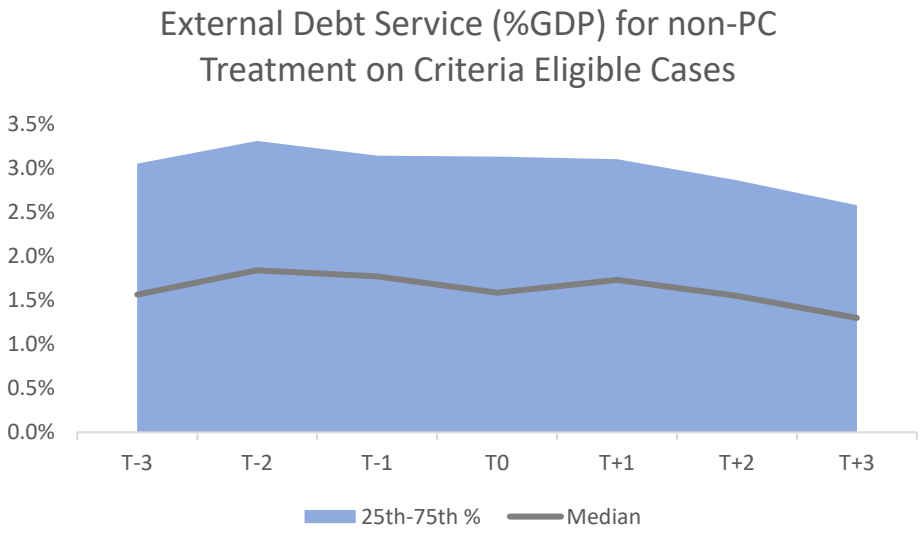
It should come as no surprise that countries who benefit from large reductions in their debt stock, as discussed in the previous section, would also witness a larger reduction in their external debt service payments compared to those that did not see similar reductions. This change is most stark when one considers the change in average external debt service paid in T_3 compared to T_0. This measure shows a c. 24% (% change; 2.14% to 1.67%) reduction for countries receiving Paris Club treatment (this figure actually grows to a c. 32% reduction if one compares T_3 to T_{-1}; 2.43% to 1.67%) compared to a c. 5.3% increase for those that do not. This increase in external debt service paid by the non-PC treatment group could reflect the effects of a prolonged negotiation or restructuring period (perhaps arising from a more fragmented creditor

base), accrued interest penalties, or other macroeconomic factors that could be examined in future research.

Despite the debt reduction in average debt service paid, the cumulative external debt service paid over the period of T_0 to T_3 is quite similar for both groups; a total of 7.66% of GDP for those receiving Paris Club treatment compared to 8.56% for those that do not. This is largely explained by the heterogeneity of groups (and shown through differences in means prior to treatment). While the debt to GDP ratio decreases from a median value of c. 86% in T_{-1} to c. 51% in T_3 countries receiving Paris Club treatment, this ratio compares similarly to the median debt to GDP ratio of c. 46% for countries not receiving treatment, thus explaining similarites in cumulative debt service payments.

When we consider the path of external debt service on the criteria-eligible group, I find that despite a decline in annual debt service payments from T_1 to T_3, the cumulative debt service paid is 8.77% of GDP. This figure is higher than both the group receiving Paris Club treament and the non-Paris Club group and is likely driven by higher starting levels of debt (as defined by our cutoff criteria for inclusion) and the lack of subsequent debt relief in periods following T_0.

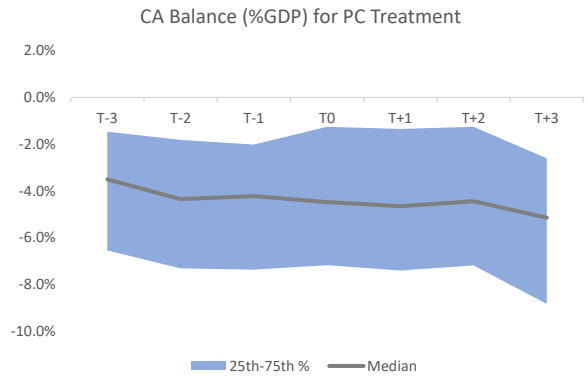
Figure 19. External Debt Service (%GDP), Pre and Post Default, for non-Paris Club Treatment on Criteria Eligible Cases

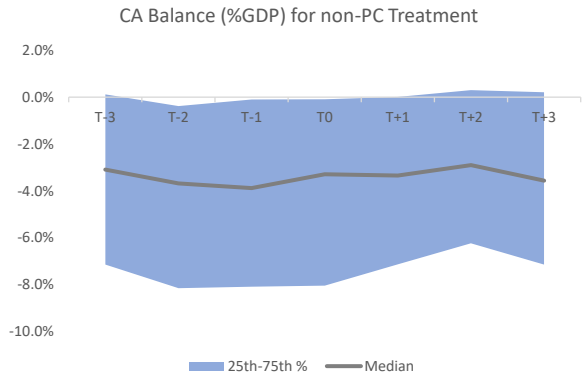


Note: Figure 19 shows the median external debt service, in percent of GDP, for the criteria-eligible group of countries between T_{-3} and T_{3}. This group did not receive Paris Club treatment but would have been eligible based on individual debt to GDP levels in year T_{-1}. The cumulative external debt service for the criteria-eligible group T_0 and T_3 was 8.77%, higher than both the non-Paris Club and Paris Club treatment groups.

d. Effect of Paris Club Treatment on the Current Account Balance

Figure 20. Current Account Balance, % GDP, Pre and Post Default, Paris Club vs non-Paris Club Treatment





Average Cumulative Current Account Balance, %GDP, T_0 to T_3: -17.96%	Average Cumulative Current Account Balance, %GDP, T_0 to T_3: -15.12%

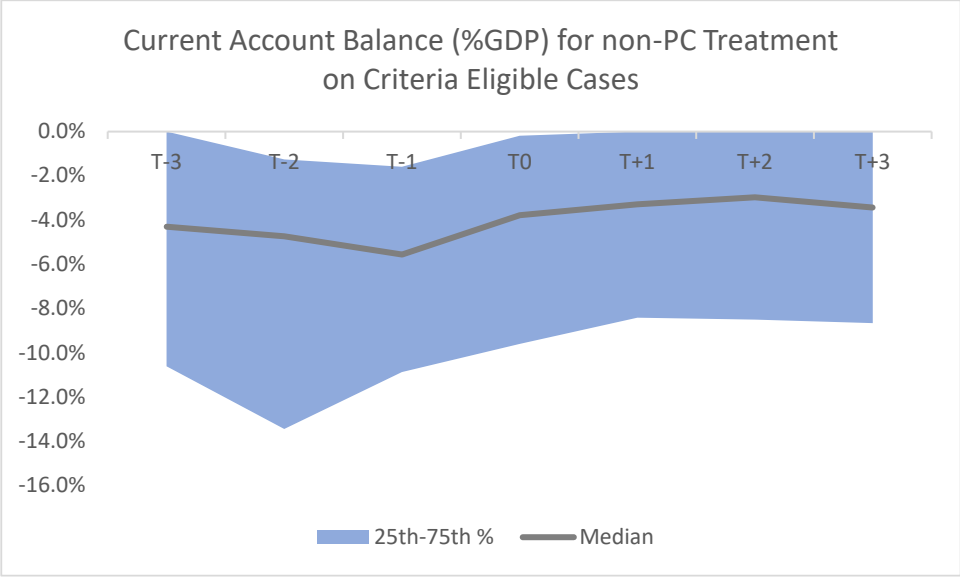
Note: Figure 20 shows the change in countries' current account balance, as a percent of GDP, between T_{-3} and T_3 for those receiving Paris Club treatment vs. those that did not. On average, countries that receive Paris Club treatment observed slightly larger current account deficits than those that did not.

When I consider the path of current account balances, in percent of GDP, the performance of countries receiving Paris Club treatment compared to those that do not is mixed. While median values are negative for both groups over the period of T_0 to T_3 (meaning that both groups were, on average, running current account deficits), the performance is worse for those receiving Paris Club treatment, witnessing an average cumulative current account deficit of 17.96% over this period. This compares to a 15.12% cumulative deficit for countries not receiving this same treatment. This result should not be surprising due to the catalytic role of the IMF as frequently discussed in the literature on sovereign restructuring. As Bordo, Mody, and Oomes (2004) and Rodrik (1995) note, the presence of the IMF provides a "good housekeeping seal of

approval" to commerical creditors and can "induce lenders to roll over their credit and, hence, prevent an exodus of capital from the country" (Bordo, Mody, and Oomes 2004). A secondary, and perhaps perverse, outcome of induced confidence on behalf of commercial lenders is that it might encourage excessive lending, especially at times when countries should be aiming to reduce their overall debt burdens, at least partially through current account improvements. As Bordo, Mody, and Oomes go on to state, "IMF lending could also encourage moral hazard, inducing private lenders to be careless in their credit decisions in the expectation of being bailed out" (2004), ultimately, resulting in concerns of future, or serial, default.

The path of the current account balance for the criteria-eligible group is actually worse than both the Paris Club and non-Paris Club treatment groups, recording an average cumulative current account deficit of 22.47% over the period of T_0 to T_3.

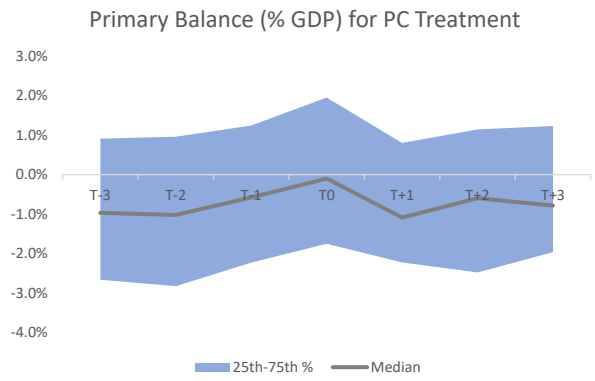
Figure 21. Current Account Balance (%GDP), Pre and Post Default, for non-Paris Club Treatment on Criteria Eligible Cases

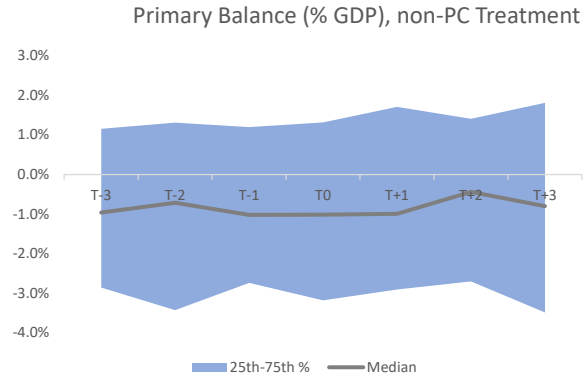


Note: Figure 21 shows the median current account balance, in percent of GDP, for the criteria-eligible group of countries between T_{-3} and $T_{3.}$ This group did not receive Paris Club treatment but would have been eligible based on individual debt to GDP levels in year T_{-1}. The cumulative average current account deficit for the criteria-eligible group T_0 and T_3 was 22.47%, higher than both the non-Paris Club and Paris Club treatment groups.

e. Effect of Paris Club Treatment on the Primary Fiscal Balance

Figure 22. Primary Fiscal Balance % GDP, Pre and Post Default, Paris Club vs non-Paris Club Treatment





Average Cumulative Primary Fiscal Balance, %GDP, T_0 to T_3: -2.71%	Average Cumulative Primary Fiscal Balance, %GDP, T_0 to T_3: -3.25%

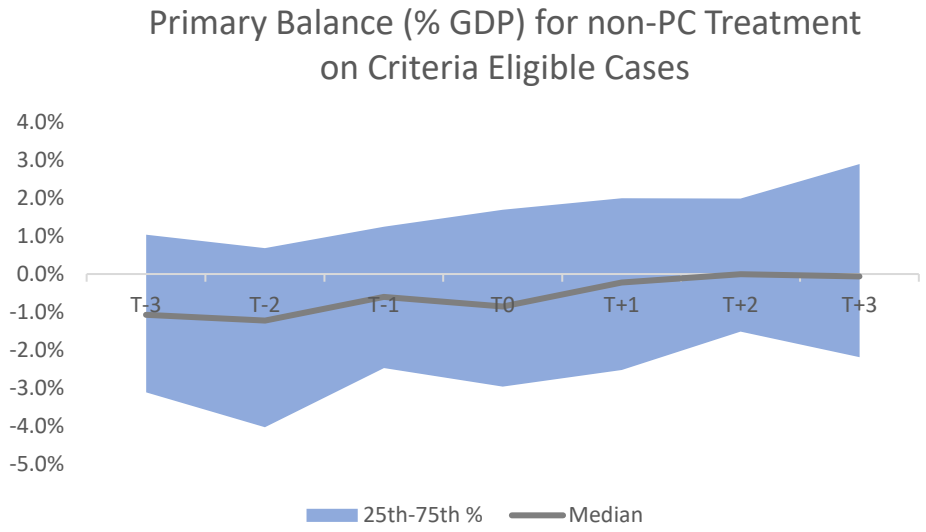
Note: Figure 22 shows the change in countries' primary fiscal balance, as a percent of GDP, between T_{-3} and T_3 for those receiving Paris Club treatment vs. those that do not. On average, countries that receive Paris Club treatment witness slightly larger primary fiscal deficits than those that do not.

Given the necessary involvement of the IMF through "an appropriate IMF-supported program" in order for a country to receive treatment from the Paris Club (Buchheit et al. 2019; Imam 2008), one would expect to find significant improvements in a country's primary fiscal balance, as the IMF has historically placed significant emphasis on fiscal consolidation in order to resolve debt issues (Baum, Poplawski-Ribeiro, and Weber 2012; Estevao and Samake 2013). While it is true that over the period of T_0 to T_3, the average primary fiscal balance of countries receiving Paris Club treatment is indeed better than those that do not, -2.71% compared to -3.25%, this amount is slightly skewed due to the strong performance by PC treatment countries in year T_0 (perhaps in order to appease creditors in order to be eligible for treatment). In fact, if I drop T_0 (the year in which the country received treatment) from my observations

and simultaneously extend the sample to T_5, the comparative performance of these two groups invert, showing that countries receiving Paris Club treatment saw a cumulative average primary fiscal balance of -4.17% compared to -3.36% for those that did not. A cynical explanation for this phenomenon might be that countries are no longer forced to undergo politically challenging fiscal consolidation/austerity measures once they have already received the prize of debt relief (De Mesquita 2011). An alternative explanation for these results might stem from the fact that countries that receive debt relief are not forced to rely solely on fiscal consolidation as a means of reducing their debt ratios and are thus free to use fiscal policy as a tool to aimed at development and growth oriented policies. As found by Clements, Gupta, and Nozaki (2011), this is indeed what occurred in IMF supported countries, which see an increase in both education and health spending.

The path of the primary fiscal balance for the criteria-eligible group is actually better than both the Paris Club and non-Paris Club treatment groups for both the period of T_0 to T_3 and T_{-1} to T_3, recording average cumulative primary fiscal deficits of 1.57% and 2.46%, respectively.

Figure 23. Primary Fiscal Balance (%GDP), Pre and Post Default, for non-Paris Club Treatment on Criteria Eligible Cases



Note: Figure 23 shows the median primary fiscal balance, in percent of GDP, for the criteria-eligible group of countries between T_{-3} and T_3. This group did not receive Paris Club treatment but would have been eligible based on individual debt to GDP levels in year T_{-1}. The cumulative average primary fiscal deficit for the criteria-eligible group T_0 and T_3 was 1.57%, lower than both the non-Paris Club and Paris Club treatment groups.

Stylized Facts of Macroeconomic Outcomes of Paris Club Treatment

Ultimately, as a result of these findings, it is hard to conclude that countries that receive Paris Club treatment are definitively better off. While it is true that the reduction in debt stock appears substantially greater under this treatment (and subsequently appears to result in higher growth levels, perhaps linked to a higher degree of fiscal space resulting from reduced debt service payments), the remaining variables that I considered show an ambiguous outcome at best. This finding is further confirmed when we consider the path of the criteria-eligible set of countries that one might expect to perform the worst due to a high starting level of debt while also not qualifying for Paris Club treatment. The actual results of this group, however, show a range from the best

performing outcomes when considering the path of the primary fiscal balance to falling between the Paris Club and non-Paris Club treatment groups for both real GDP growth and decline in debt to GDP ratios.

Furthermore, when considering the different outcomes between the Paris Club treatment group and the non-treatment group, the lack of improvement in the primary fiscal balance of countries receiving treatment likely has the effect that there is a welfare gain for its citizens as a result of lesser austerity measures than perhaps expected.[48] This additional domestic spending would likely result in increased growth as previously discussed, ultimately benefiting the populace (Leigh, Pescatori, and Guajardo 2011; Blanchard and Leigh 2013). However, the lack of improvement in either the primary fiscal balance or the current account balance, while providing a short-term welfare gain for the country, might induce a behavioral effect that results in future negative outcomes as a result of delaying required policy action. In extreme cases, these findings are likely to represent the performance of countries receiving treatment in return for assurances of future policy adjustments that do not materialize. The immediate benefits of witnessing a large debt stock reduction and subsequent delays in policy action could result in a second default, which will be discussed in the following section.

[48] The result of debt relief, in effect, is that the cost of policy adjustment is borne partly by external creditors, rather than solely by the debtor's populace.

IV. Has Debt Restructuring via the Paris Club Prevented Serial Default?

The primary aim of the Paris Club is to find 'sustainable solutions' and to aid debtor countries in undertaking "reforms to stabilize and restore their macroeconomic and financial situation" (Club de Paris n.d.). By definition, any sustainable solution to the difficulties faced by debtor countries will include the aim of preventing a subsequent default. While current literature on sovereign default (IMF 2015c; Buchheit et al. 2019; Roos 2019) includes frequent mention of: the Paris Club, Paris Club treatments, or the workings of the Paris Club, there appears to be a lack of empirical analysis done to date on whether or not Paris Club treatments on debtor countries have actually resulted in positive outcomes. In the previous section I considered the impact that Paris Club treatment has on various macroeconomic indicators; however, the ultimate marker of whether these effects have positive outcomes is whether they aid debtor countries in avoiding subsequent defaults, a.k.a. serial defaults. Using the aforementioned dataset on sovereign default and distress episodes as well as the data I have gathered on Paris Club treatments, I have conducted a second round of analysis attempting to answer this important question. After separating defaults that were recorded as a result of Paris Club treatment and those that resulted from non-Paris Club treatment, I was able to consider whether the countries experienced a subsequent default (Start of Default) or distress (Start of Distress) events within either the next 5- or 10-year periods. Out of a total of 156 observations of default recorded as a result of Paris Club treatment, I found 47 cases of subsequent default occurring within 5 years of the initial treatment, 94

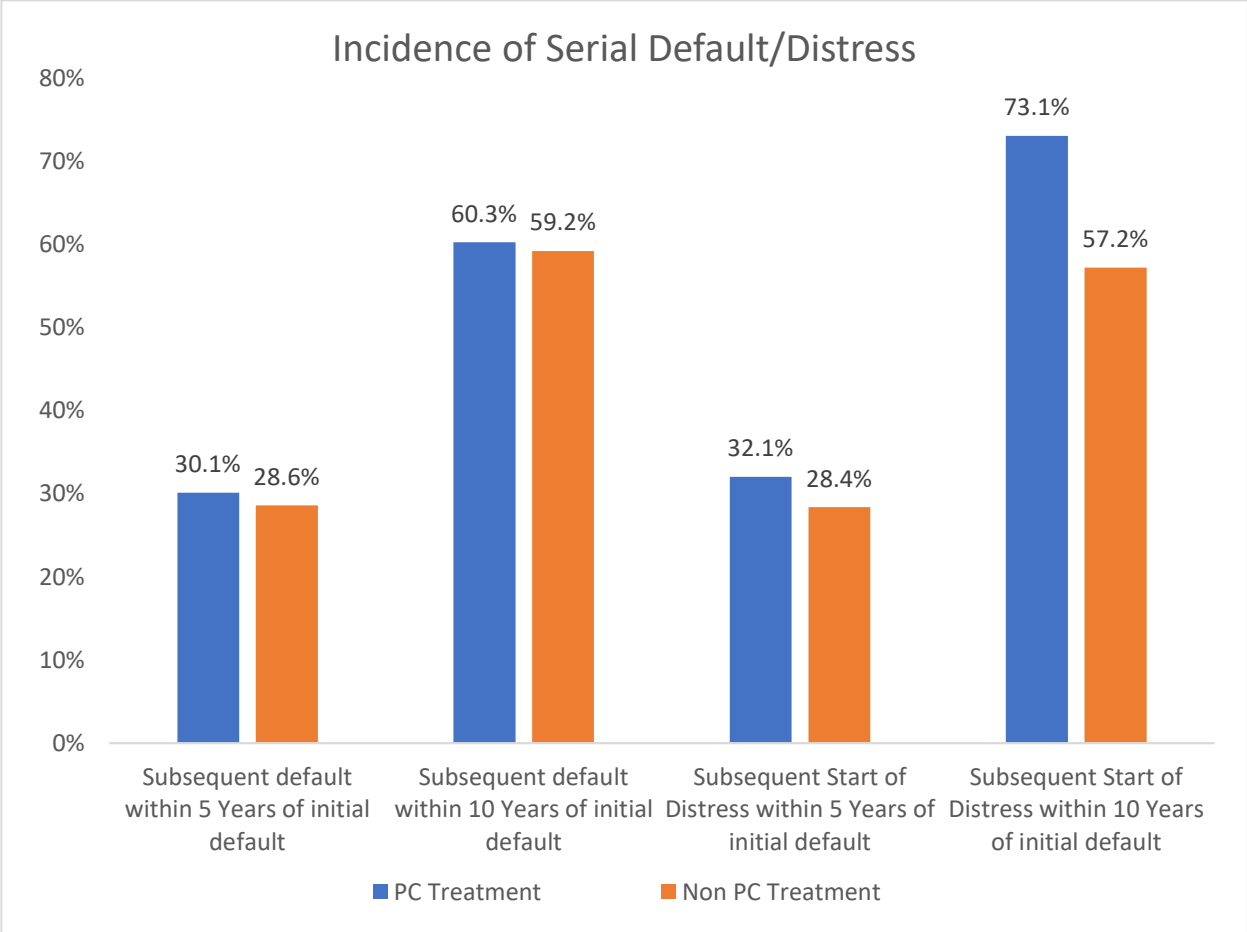
episodes occurring within 10 years;[49] 50 episodes of new distress occurring within the first 5 years of the initial treatment, and 114 episodes occurring within 10 years. Next, I considered non-Paris Club defaults.[50] Out of a total of 493 observations, I found 141 cases of subsequent default occurring within 5 years of the initial treatment, 292 episodes occurring within 10 years; 140 episodes of new distress occurring within the first 5 years of the initial treatment, and 282 episodes occurring within 10 years.[51] The percentage of subsequent default and distress episodes is shown below:

[49] Where the 5-year set is a strict sub-set of the 10-year set (for both default and distress), i.e., a total of 94 10-year observations result in a net increase of 47 additional default observations that occurred between year 6 and 10. The fact that this amount is exactly double the number of 5-year observations is purely coincidental.

[50] As in the previous section, non-Paris Club defaults are defaults that were recorded from events other than Paris Club treatment and do not contain any PC treatment that occurred within +/– 2 years of the recorded default.

[51] It is important to note that start of default episodes are not a strict subset of start of distress episodes as countries might remain 'in distress' but not 'in default' following default, thus precluding a 'start of distress' from being recorded, however, not preclude a 'start of default' observation.

Figure 24. Incidence of Serial Default/Distress Following Initial Default, Paris Club and non-Paris Club Treatment.



Note: Figure 24 shows the percent of serial default and distress episodes observed in countries that receive Paris Club treatment vs. those that do not over a 5- and 10-year period following default. In each of the four categories, countries that receive Paris Club treatment observe a higher incidence of serial default and distress episodes.
Source: Dielmann Default Data.

From the Chart, I observe that countries receiving Paris Club treatment actually faced a higher likelihood of witnessing subsequent episodes of both default and distress at the 5- and 10-year period. Notwithstanding the aforementioned differences in selection of countries that do and do not receive Paris Club treatment, these results should clearly be considered surprising/counter-intuitive given the aforementioned aim

of the Paris Club. Additionally, these results support the earlier discussion that large reductions in debt stock can result in avoiding necessary policy adjustments, particularly regarding the primary fiscal balance, to prevent subsequent defaults. Even in the absence of comparison across groups, the high observation of subsequent default and distress events, of 60.3% and 73.1% respectively, recorded within a 10-year period of receiving both debt relief and an IMF supported lending program should be considered worrisome at the least.

V. Conclusion

Given the results of the regression models and sample statistics, this thesis finds that, to date, there do not appear to be any statistically significant measures showing that an increase in Chinese lending has led to higher incidence of distress episodes for borrower countries. While this result may appear surprising at first take, a number of factors needed to be considered in order to frame this conclusion.

First, while I have a measure of both total debt as well as debt to owed to China, it appears that the likelihood of observing a distress event is determined less by the identity of creditors and more by a country's total amount of debt. If this is indeed the case, then the question becomes how much countries that have borrowed from China would have borrowed otherwise, i.e., the counter-factual scenario. Without being able to control for the degree of substitution between creditors that occurred for borrowing countries, it will be impossible to answer this question. As previously mentioned, Chinese lending to Africa on an annual basis peaked in 2013, coinciding with the launch of the Belt and Road Initiative, and has been declining since (Acker and Bräutigam 2021). This finding provides at least some evidence that debtor countries have been able to fill their financing gap with borrowing from sources other than China.

A second question addressed was whether there is something inherently unique about Chinese lending that, without regard to the total amount in US$ or as a percent of the borrower's GDP, makes a country more or less likely to default. As previously noted, Chinese lending does have a few unique characteristics involving both the creditor classification, i.e., whether they will be classified as either official or commercial lending,

a lack of transparency resulting from included non-disclosure agreements (Malpass 2020), as well as the inclusion of express ‘no Paris Club’ or ‘comparability of treatment’ clauses (Gelpern et al. 2021). While these factors are problematic, for a host of reasons discussed, recent events suggest that they might be less drastic than once feared. For one, in regard to creditor classification, although both China Development Bank (CDB) and the Industrial and Commercial Bank of China (ICBC) were classified as commercial creditors and thus fell outside of the scope of the G20’s Debt Service Suspension Initiative, China was willing to restructure the loans of both creditors in the case of Angola (See Box 2; IMF 2021a). Furthermore, as a signatory to the G20’s Common Framework that requires equal burden sharing as well as transparency of claims, China has further shown a willingness to engage within the international financial architecture to pursue joint solutions for debt relief despite its historic desire to pursue bilateral solutions (Acker, Bräutigam, and Huang 2020). This development could, de facto, negate China’s ability to enforce prior contractual obligations – “confidentiality” and “no Paris Club” clauses - signed by debtor countries that prevent disclosure and comparability of treatment (Gelpern et al. 2021), both of which stand in direct contrast to the DSSI and the Common Framework. However, the framework’s intent to handle debt treatments on a case-by-case basis will continue to allow China to retain the ability to unilaterally determine which creditors will or will not be included in any restructurings, creating further tension between the official and private sector.

A lack of transparency regarding China’s lending does remain an issue not only for private creditors who are thus unable to properly price the risk of the borrowing country’s commercial debt, but also for official creditors, that require a clear

understanding of a country's true liabilities in order to design both a package of debt relief as well as an IMF program in order to restore the debtor country to debt and fiscal sustainability. The case of the Republic of Congo is serving as an important test case. It appears so far that when a deep restructuring of a country's liabilities is needed, China is indeed willing to work with international partners and provide transparency, at least to the degree that their claims are centrally known (Gulde 2018). The opacity of outstanding claims is perhaps likely less a danger in the form of designing an incomplete package of relief as in leading to a delay in which this package is delivered. This was also reflected in the case of Zambia.

This thesis also finds that the macroeconomic outcomes of countries receiving Paris Club treatment compared to those that do not are mixed. While we do witness significant reductions in debt stocks associated with treatment as well as improved growth figures, the effect on the primary fiscal balance and current account balance of debtor countries is both less beneficial and less conclusive as determined by means and variance tests. Additionally, the higher observed incidence of both default and distress episodes following Paris Club treatment suggests that the current system is not sufficient in preventing serial default or inducing the required country behavior to ensure medium- to long-term sustainability. This should serve as further evidence to suggest that if China were willing to accept membership into the Paris Club, it would not result in the resolution of all concerns that have been raised about China's growing presence within the sovereign lending landscape. To put this more succinctly, an enlargement of Paris Club membership alone is unlikely to serve as a panacea for avoiding future sovereign defaults.

Based upon this discussion, this thesis finds that despite a lack of transparency and the inclusion of strict anti-collaborative provisions within Chinese lending contracts, their use has not led to a systematic increase in sovereign distress episodes. This ultimately support the work of Bräutigam and Rithmire that claims of China's 'debt-trap diplomacy' (2021) lack supporting evidence in practice.

VI. Discussion on Steps for Further Research

In this thesis, I have attempted to isolate the effect that additional Chinese lending has on the likelihood that a country will be in a state of distress. In order to do so, I have tested whether two variables on Chinese lending (those being the Log of Debt owed to China in US$ and Debt owed to China as a percent of the borrower's GDP) in my regression models are shown to have any statistical significance in predicting distress events when compared to regression models without these variables. I have, however, left the binary dependent variables (those being ii) In Distress and iv) Start of Distress unchanged. To further examine the effect that Chinese lending has, I propose repeating the previous exercise by amending the dependent variable to include additional incidence of distress where China agreed to pursue loan modifications (including restructuring, reprofiling, or refinancing). In order to do this, I have created an additional dataset on modified Chinese loans from a variety of data sources that are listed below.

Table 10. Data Sources on Chinese Loan Modifications

Author	Dataset / Source	Country Coverage	Time Coverage	Total D/D Incidence
Center for Global Development	Examining the Debt Implications of the Belt and Road Initiative from a Policy Perspective	52 [2,3]	2000-2017	85
China Africa Research Initiative	Debt Relief with Chinese Characteristics	12 [2,3]	2002-2019	18
Rhodium Group	New Data on the "Debt Trap" Question	22 [2,3]	2001-2019	43
Rhodium Group	Seeking Relief: China's Overseas Debt After COVI	15 [2,3]	2014-2020	18
Merged Dataset		**64** [2,3]	**2000-2020**	**140**

Note: A complete list of sources can be found in the references section.

1/ Contains observations on Advanced Market Countries

2/ Contains observations on Emerging Market Countries

3/ Contains observations on Low-Income Countries

Note: Table 10 shows all sources of Chinese loan modifications used to create the merged dataset. This data is not used in my statistical analysis of Chinese lending but could be used to modify the dependent binary variable 'In Distress' in future analysis.

This dataset contains 140 observations of remodification of loan terms with Chinese creditors that could be classified as distress events. The addition of these observations within the dependent dummy variable might result in additional significance of Chinese lending when testing using the four logistic regression models, particularly in cases where the predicted probability, p, is low. It is important to note, however, that 68 of these observed cases were already recorded as distress event in my dataset. As a result, the addition of this dataset leads to a net increase of 72 distress observations. While outside the scope of this thesis, additional research could be conducted, likely via case studies, on the already included 68 observations, looking specifically at whether the distress occurred as a result of modification on Chinese loans, or if these modifications occurred as a result of distress the country was independently experiencing.

Limitations on Chinese Lending Data

There are a number of important factors to note when interpreting the prior results, the first being that the observed data on Chinese lending is relatively young compared to data that have been collected on sovereign defaults/distress events as well as other macroeconomic data (those being used as independent and control variables in my models). This results in two outcomes, the first is that a significant number of observations from the initial balanced panel of 9,843 CountryYear observations is dropped for years in which I do not have data on Chinese lending. While the remaining dataset is sufficiently large for measurement, the number of usable observations should continue to grow in lockstep with the growth of data on Chinese lending, thus continuing to strengthen the results of any model tasked with determining causality of the variables of interest.

Another issue relates to the accuracy of the data being used to measure Chinese lending. I have opted to use the 'Chinese Overseas Lending' dataset that was produced by Horn, Reinhart, and Trebesch, hereafter 'HRT', (2019). The reason that I have done so is that, to date, it is the only available data source that aggregates various independent sources to create a dataset of global coverage. While in some instances alternate datasets contain a more detailed breakdown of Chinese lending, especially in regard to loan level data (such as a SAIS CARI[52] and AidData,[53] etc.), these datasets were not useable for my work as their country coverage is simply not sufficiently

[52] See SAIS China Africa Research Initiative. "Loan Data."
[53] See Dreher et al., 2017

comprehensive. Additionally, I was apprehensive of using various datasets to create a merged dataset as I would not be able to guarantee that collection methodologies used by various authors would be not sufficiently similar for use in a statistical application.

The HRT dataset has also received various criticism from other authors, specifically from the team at SAIS CARI (Bräutigam and Acker 2020) regarding the accuracy of the loan data, specifically that the HRT Dataset relied on 'contracted' rather than disbursed loans. While this distinction may seem trivial and esoteric at first glance, the implications of this distinction could actually result in significant differences. Contracted debt refers to the total amount of debt that the creditor agrees to lend to the borrower, i.e., if China agrees to lend US$ 1 bln. to a debtor country over a ten-year period, the contracted amount would then be US$ 1 bln. If, however, the debtor country only winds up borrowing a fraction of this amount, say US$ 250 mln., this would refer to the disbursement amount, i.e., the amount that the debtor country actually received. The statistical implications of US$ 1 bln. vs. US$ 250 mln., might be trivial in some cases while significant in others, especially in regard to the likelihood that a country finds itself in default. HRT have responded to this criticism and have actually suggested that their findings, despite relying on contracted sums, are likely to represent a lower bound of the actual amount of borrowing that countries have received from China (Horn, Reinhart, and Trebesch 2020). While I am not in a position to judge the merits of either claim, I certainly acknowledge that, in addition to the opacity surrounding Chinese loan terms, there is also opacity in regard to which numbers one should use to measure it.

With this potential shortfall noted, there are two possible effects that discrepancies in the HRT data could pose. The first is a form of ex-ante or expectation about the effect that additional lending would have, i.e., one might expect that it is in fact the disbursement of debt, rather than the contracting of debt, that would result in a country finding itself in debt distress. This would be the case if one believed that a country's additional debt service payments resulting from Chinse borrowing, occurring at the margin, are the straw that broke its back in terms of solvency. The ex-post, or after the default, response to this might be, however, that if one observed a country that did find itself in distress, and one were unable to find any statistical significance to suggest that the contracted Chinese lending (the upper bound value of the two) played a part, then one would assume that a lesser amount of disbursed debt would have resulted in even lower significance. Ultimately, without comprehensive data available for comparison purposes, it will be impossible to determine the true impact that this discrepancy in data might cause in terms of over or under attributing significance to Chinese lending.

Default vs. Distress

In this thesis, I have only considered 'distress' observations rather than 'default' observations, as my dataset contains significantly more observations of being in distress rather than being in default (2,877 vs 1,675). While the larger number of positive observations provide a stronger 'signal,' it would likely produce a more reliable cutoff criterion if using a standard Noise-to-Signal approach. As I am testing total predictive power using the AUC, however, there would be no reason to assume that

distress rather than default variables would produce stronger results. These models could be rerun using the 'default' dummies ('In Default' and 'Start of Default') rather than dummies on 'distress'.

Number of Lags

As previously discussed, I am currently employing a 1-year lag of my independent variables to test for whether a country will be in distress or witness the start of a distress event. In conversation with the IMF's Strategy, Policy and Review Department, however, I have learned that their recent early-warning indicator model employs a forecast window of 2 years, rather than a point-wise forecast horizon.[54] Preliminary testing suggests that the inclusion of a second lagged term for each independent variable does lead to an increase in total predictive power of the models as measured by the AUC, however, it also results in lowered significance of individual covariates.

Arrears Threshold

As previously discussed, for any CountryYear observation in which arrears become present or where there is an increase arrears by a factor for 2 or greater, this is considered as being a start of distress observation.[55] The factor of 2X was chosen to

[54] Interview conducted with the IMF's Strategy, Policy and Review Department regarding the "Review of The Debt Sustainability Framework For Market Access Countries" on February 10, 2021 (IMF Strategy, Policy and Review Department, 2021).

[55] By definition, any observed default observation will necessarily also be considered a start of distress episode where the binary dependent variable 'In Distress' will also be set equal to 1. The CountryYear observation will also be considered as being in distress and in default (with 'In Distress' and 'In Default' being equal to 1).

capture non-insignificant increases of arrears scaled to the existing level of arrears normalized relative to each country's size of outstanding arrears at the time of increase.

Regarding the two rules that govern the coding of 'Start of Default', the first rule is likely quite intuitive in that a default should be recorded when a country begins to run arrears; legally obligated payments were missed, thus a default occurred. The latter rule, regarding the doubling over previous year's arrears, is likely less intuitive. The reason that this has been coded as such is to capture new arrears that result from a new observation of missed payment. When considering the dataset, it is quite clear that once a country begins to run arrears, they are likely to remain in arrears for a number of years until a resolution can be found and the arrears can be cleared. In fact, the most common pattern within in the data is that arrears are zero until a default occurs, arrears then become present, and then decline over the next period of years as arrears are paid off/cleared. As discussed, the presence of these arrears indicates a specific vulnerability of the observed CountryYear, in that the country is still indebted following missed payments. However, one should not view each year in which arrears are present as suggesting that a Country is in either default or distress, especially if the outstanding arears balance is being cleared following an agreed upon payment schedule. Additionally, small increases in the outstanding arrears balance should also not be considered new episodes of default or distress as it is likely the case that these increases are the result of the country accruing interest penalties on their arrears balance. If, however, one witnessed the outstanding balance of arrears increasing by a significant amount, then one could conclude that this occurred as a result of additional missed payments rather than simple penalty accruals. It is thus likely that these

observations represent a new and unique episode of default. It is important to note, however, that in order for these observations to be considered new default observations within my merged Default Dataset, it may also be the case the country was neither in distress nor in default within the 2 previous years.

How could these models be Strengthened?

With so many questions faced in the economic and social sciences, the ability to accurately address them is often constrained by data availability. As previously noted, my dataset began as a strongly balanced panel consisting of Country and Year observations between 1970 and 2020, resulting in 9,843 observations. However, an equal number of data series of relevant covariates are not available for this entire time period. For example, the IMF's WEO (2020b) database begins in 1980, UN ILO data on unemployment begins in 1990 (n.d.), and the HRT data on Chinese lending begins in 2000 (2020). When I combine the limitations of these series as well as missing observations, being the most common in low-income and developing countries where data collection can be challenging, I am left with 2,717 observations, slightly less than 30% of the initial number of observations. Another challenge is that many potentially relevant datasets are only available for sub-samples of all countries. The World Bank's International Debt Statistics dataset (IDS; 2020), for example, contains an impressive collection of variables seemingly relevant for this work, including data on debt service payments, total debt, total external debt etc. all broken down by creditor type. The issue, however, is that its data is only available for low-income countries, thus excluding many emerging and advanced markets, including many episodes from noted serial defaulters

such as Argentina and Chile, as well as more prominent observations such as Russia (1998) or Greece (2015). Another dataset that would likely serve as useful control variables is the World Bank's Country Policy and Institutional Assessment (CPIA) database (World Bank 2019). This database and rating methodology assigns scores based on countries' assessed strength of public sector management, institutions, and governance, in particular, topics that rate countries' strength in economic and debt management. As with the IDS dataset, however, CPIA ratings are only available for IDA eligible countries,[56] thus making them impossible to use as a universal control variable across the entire sample.

The inverse of this issue is true when constructing my dataset on default/distress observations. The latest guidance note on the IMF's MAC DSA Review (2021c) includes a list of 482 distress events featuring 77 countries between 1990 and 2007. However, this sample only includes 'market access countries' (MAC), being defined as countries that are not PRGT eligible, thus excluding the 67 poorest countries (IMF 2021c).[57] Unfortunately, the 2017 review of the LIC DSF does not make public the list of distress events used in its probit estimation (IMF 2017).

One variable that is frequently cited, particularly in the private sector, as being a metric of risk is bond yields. I have intentionally decided to omit yields from my dataset for two reasons; the first being that I am considering all episodes of sovereign distress or default, including those that do not stem from bond defaults as well as from countries that have not issued bonds, such as low-income countries that might rely on official

[56] See Appendix for list of all IDA eligible countries (World Bank n.d.).
[57] See Appendix for a list of all PRGT eligible countries (IMF 2021d).

lending. Bond yields fundamentally represent an additional dependent variable, i.e., being dependent on fundamental factors such as the independent variables already used throughout my model. As bond yields change in real-time, resulting from the market's response to their perception of underlying changes in country fundamentals, it represents a reactionary rather than predictive variable and potentially leads to reverse causality issues. However, it would be possible to propose additional research using a multi-stage model: first determining the relationship between yields and default, then running a linear pooled OLS regression using a host of independent explanatory variables on the yields, and finally using predicted Yhat values as a measure of default. This method might provide a few statistical advantages, such as using linear predictors, ignoring the effect of compressions (Berry, DeMeritt, and Esarey 2010), or the ability to control for heteroskedasticity. However, these benefits are likely to be offset by an additional data challenge - that being that bond yields are readily obtainable from sources such as Bloomberg on daily frequency, while other independent variables are likely only available on an annual basis (WEO, IDS, ILO, etc.). This difference in reporting period could be partially corrected by annualizing yield data through simple averaging; however, this would result in the loss of the timely response that yield data can provide. A more beneficial improvement would be to shorten the collection period of the included independent variables. Some national statistical agencies, primarily those located in higher-income advanced economies, already report certain macroeconomic data on a quarterly basis, such as GDP growth, inflation, unemployment, etc. This, however, brings us back to the earlier problem that many datasets are only available for subsets of countries. Thus, until there is a global push for more rapid and

comprehensive data collection, it is unlikely that researchers will overcome these particular challenges.

Additional research could be considered using alternative model specifications. One such model that could be considered for further research might be to use a Poisson regression model that uses categorical dependent variables rather than binary dependents. As previously discussed, the reason that I have opted for the use of a logistic regression model is due to the fact that my dependent variable is a binary categorical variable, i.e., 0 in the case of no distress and 1 in the case of distress. If, however, a new dataset could be created that were able to assign rank to differing degrees of distress, e.g., 0 for no distress, 1 for in distress, 2 for loss of market access, 3 for in technical default, 4 for in full default, etc., other types of regression models could be employed. In this case, a Poisson model would be more appropriate than a logistic model. I will refrain from speculating whether this would provide additional statistical significance, but it is an area that should be considered for further research.

Appendix

Equation 2. Derivation of the Logistic Regression Model

Logistic regression models differ from linear regression models in that they regress a series of independent variables onto binary response variables, such that Y will be equal to 1 when the observation of interest is 'true' and equal to 0 when 'false'. In the dataset, these response to the binary dummy variables 'In Distress' and 'Start of Distress' which are equal to 1 in CountryYear observations in which a country was either in distress or I record the onset of a distress event.[58] The model then assumes that the log-odds ratio of K observation as a linear function of x.

(1) $$ln\frac{p(x)}{1-p(x)} = \sum_{j=0}^{K} b_j x_j$$

Where b is the coefficient on the independent variable x, for all j, and Sigma, Σ, is the sum of the subsequent factors.

Taking the exponent of both sides of the expression yields:

(2) $$\frac{P(x)}{1-p(x)} = e\left[\sum_{j=0}^{K} b_j x_j\right] = \prod_{j=0}^{K} e\left(b_j x_j\right)$$

Where e is the exponent function and Pi, Π, is the product of the subsequent factors.

(3) $$P(x) = \frac{e(z)}{1+e(z)}$$

[58] Credit for the derivation, see: Agresti (2002), Hastie et al. (2009), Hosmer and Lemeshow (2011), and Nzumel (2011)

(4) $$z = \sum_{j=0}^{K} b_j x_j$$

Where the function is bounded by $P(-\infty) = 0$ and $P(\infty) = 1$. Hence, as z approaches negative infinity, the numerator of this expression will equal to approach 0 and the denominator will approach 1+0=1. Hence, the value of the function as z approaches negative infinity will be 0.

Where the expression $\frac{e(z)}{1+e(z)}$ is the sigmoid function of (z), and is bounded by the earlier limits of 0 and 1.

Rewriting this expression as

(5) $$p(z) = \frac{e(z)}{1+e(z)} = e(z) \cdot \big(1 + e(z)\big)^{-1}$$

And then taking the derivative of P (chain rule) results in:

(6) $$P'(z) = e(z) \cdot \big(1 + e(z)\big)^{-1} + e(z)(-1)\big(1 + e(z)\big)^{-2}\big(e(z)\big)$$

(7) $$= \frac{e(z)\big(1+e(z)\big)}{\big(1+e(z)\big)^2} - \frac{\big(e(z)\big)^2}{\big(1+e(z)\big)^2}$$

(8) $$= \frac{e(z)}{\big(1+e(z)\big)^2}$$

(9) $$= \frac{e(z)}{\big(1+e(z)\big)} \cdot \frac{1}{\big(1+e(z)\big)}$$

(10) $= \big(P(z)\big)\big(1 - P(z)\big)$

Unlike linear regression models that fit the slope of the regression line using the ordinary least squares methodology, logistic regressions rely on maximum likelihood estimators of N individual observations.[59]

(11) $L(X|P) = \prod_{i=1,y_1=1}^{N} P(x_i) \prod_{i=1,y_1=1}^{N} \big(1 - P(x_i)\big)$

Where (X, y) is the observation set, X is a K+1 by N matrix of inputs, where each column responds to an observation

(12) $L(X|P) = i = \sum_{i=1,yi=0}^{N} lnP(x_i) + \sum_{i=0,yi=0}^{N} \ln\,(1 - P(x_i))$

(13) $\nabla_b L = \sum_{i=1,yi=1}^{N} \frac{p_i'}{p_i} x_i - \sum_{i=1,yi=0}^{N} \frac{p_i'}{1-p_i} x_i$

Where Del, ∇, denotes the partial derivatives of L with respect to b.

Given that $p' = p(1 - p_i)$, this can then be rewritten as:

(14) $\nabla_b L = \sum_{i=1,yi=1}^{N} \frac{p_i(1-p_i)}{p_i} x_i - \sum_{i=1,yi=0}^{N} \frac{P_i(1-p_i)}{1-P_1} x_i$

(15) $= \sum_{i=1,j=1}^{N} \frac{P_i - P_i^2}{P_i} x_i - \sum_{i=1,j=0}^{N} \frac{P_i - P_1^2}{1-P_i} x_i$

(16) $= \sum_{i=1,yi=1}^{N} (1 - P_1) x_i - \sum_{i=1,yi=0}^{N} P_i x_i$

[59] Logistic regressions do not have residuals as they aim to maximize likelihood by minimizing deviation rather than the minimization of the residual sum of squares.

(17) $= \sum_{i=1}^{N}(y_i(1-P_i)-(1-y_i)P_i)x_i$

Row 17 combines the earlier expressions into a single sum for both $y_{i=0}$ and $y_{i=1.}$ After cancelling terms, one can maximize the expression by setting the simultaneous equations equal to 0, which results in:

(18) $\sum_{i=1}^{N} y_i x_i - P_i x_i = 0$

Rewriting and simplifying this expression gives us:

(19) $$\sum_{i=1}^{N} y_j x_{ij} - P_1 x_{ij} = 0$$

(20) $= \sum_{i=1,x_{ij}=1}^{N} y_i - P_1 = 0$

(21) $= \sum_{i=1,x_{ij}=1}^{N} y_i = \sum_{i=1,x_{ij}=1}^{N} P_i$

This final expression represents the summed probability of the marginal contributions of all $x_{i,}$ which will be equal to the total number of 'true' responses, where Y = 1.

Solving for the coefficients:

Given a vector with value equal to $f: y = f(b)$, I begin by solving for the value of b when $f(b) = 0$.

(1) $f(b_0 + \Delta) \approx f(b_0) + f'(b_0)\Delta$

Solving for delta, Δ:

(2) $\Delta_0 = -\big(f'(b_0)\big)^{-1} f(b_0)$

Where f is the gradient of the log-likelihood and is Jacobian matrix of the first derivative of f, with respect to b. It then follows that:

(3) $b_1 = b_0 + \Delta_0$

(4) $H = \frac{\partial}{\partial b} \nabla_b L$

Where H, is the Hessian matrix of the second derivative of f with respect to b. It then follows that:

(5) $H = \frac{\partial}{\partial b} \nabla_b L$

(6) $= -\sum_{i=1}^{N} x_i \nabla_b P_i$

(7) $= -\sum_{i=1}^{N} x_i P_i (1 - P_i) x_i^T$

(8) $\equiv XWX^T$

Where W is the diagonal matrix of the derivative of P'_i. Solving for Δ at each iteration of i results in:

(9) $\Delta_k = (XW_kX^T)^{-1}X(y - P_k)$

Where W is the matrix, y is the vector of observed responses, and P_k is the vector of probabilities by the estimate of b.

Figure 25. Joint Logistic Regression Output Against 'In Distress'

Model	Pooled Logit (1)	Fixed Effects (2)	Random Effects (3)	Mixed Effects (4)	Pooled Logit (5)	Fixed Effects (6)	Random Effects (7)	Mixed Effects (8)
VARIABLES	In Distress	In Distress	In Distress	In Distress	In Distress	In Distress	In Distress	In Distress
Previous Distress	1.599***	1.116*	1.788***	1.860***	1.612***	1.116*	1.811***	1.876***
	(0.268)	(0.653)	(0.325)	(0.344)	(0.268)	(0.653)	(0.326)	(0.347)
In Distress (1 year lag)	1.507***	0.802***	1.221***	1.149***	1.498***	0.800***	1.210***	1.134***
	(0.094)	(0.102)	(0.107)	(0.113)	(0.094)	(0.102)	(0.107)	(0.113)
Current Acct. Bal (1 year lag)	-0.002	-0.014	-0.005	-0.000	-0.003	-0.013	-0.006	-0.001
	(0.006)	(0.008)	(0.006)	(0.006)	(0.006)	(0.008)	(0.006)	(0.006)
Ln of Debt to GDP (1 year lag)	0.208***	0.033	0.221**	0.470***	0.198**	0.024	0.199**	0.452***
	(0.077)	(0.142)	(0.098)	(0.110)	(0.077)	(0.143)	(0.098)	(0.110)
GDP Growth, % (1 year lag)	-0.014	-0.027*	-0.018	-0.023	-0.013	-0.027*	-0.017	-0.022
	(0.012)	(0.016)	(0.014)	(0.015)	(0.012)	(0.016)	(0.014)	(0.015)
GDP Per Capita, PPP (1 year lag)	-0.0000139***	0.00000691	-0.0000146**	-0.0000178**	-0.0000166***	0.00000148	-0.0000194***	-0.0000228***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Total Reserves, USD (1 year lag)	0.100***	0.095	0.124***	0.116**	0.106***	0.150	0.143***	0.134***
	(0.030)	(0.124)	(0.043)	(0.047)	(0.031)	(0.132)	(0.045)	(0.049)
Import Cover, Months (1 year lag)	-0.069***	-0.127***	-0.093***	-0.092***	-0.070***	-0.136***	-0.096***	-0.095***
	(0.019)	(0.043)	(0.024)	(0.026)	(0.019)	(0.044)	(0.024)	(0.026)
6-Month Libor	-0.007	-0.055*	-0.011	0.687***	-0.028	-0.061*	-0.037	0.634***
	(0.023)	(0.032)	(0.025)	(0.186)	(0.025)	(0.033)	(0.027)	(0.188)
Unemployment, %	0.016**	0.099***	0.030***	0.032***	0.014*	0.095***	0.027**	0.030**
	(0.007)	(0.026)	(0.011)	(0.012)	(0.007)	(0.026)	(0.011)	(0.012)
Primary School Enrollment, %	0.007**	0.013*	0.010**	0.012**	0.007**	0.014**	0.011**	0.012**
	(0.004)	(0.007)	(0.005)	(0.005)	(0.004)	(0.007)	(0.005)	(0.005)
Life Expectancy at Birth	-0.012	-0.091***	-0.021*	-0.015	-0.013	-0.084***	-0.022*	-0.018
	(0.008)	(0.030)	(0.011)	(0.012)	(0.008)	(0.030)	(0.012)	(0.013)
Ln of Debt to China, USD (1 year lag)					-0.008	-0.013	-0.014*	-0.018**
					(0.006)	(0.010)	(0.008)	(0.009)
Debt to China, % GDP (1 year lag)					-0.012	0.000	-0.009	-0.001
					(0.010)	(0.013)	(0.011)	(0.011)
Constant	-5.324***		-5.680***	-10.863***	-5.177***		-5.725***	-10.625***
	(0.875)		(1.205)	(1.626)	(0.882)		(1.221)	(1.650)
Observations	2,717	2,367	2,717	2,717	2,717	2,367	2,717	2,717
Number of Countries	155	128	155	155	155	128	155	155
Country FE	No	YES	Yes	YES	No	YES	Yes	YES
Year FE	No	No	No	YES	No	No	No	YES
Random Effects	No	No	Yes	YES	No	No	Yes	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 26. Joint Logistic Regression Output Against 'Start of Distress'

	Pooled Logit	Fixed Effects	Random Effects	Mixed Effects	Pooled Logit	Fixed Effects	Random Effects	Mixed Effects
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Start of Distress	Start of Distress	Start of Distress	Start of Distress	Start of Distress	Start of Distress	Start of Distress	Start of Distress
Previous Distress?	1.984***	1.370**	2.223***	2.312***	1.999***	1.368**	2.248***	2.316***
	(0.263)	(0.638)	(0.378)	(0.395)	(0.263)	(0.638)	(0.378)	(0.397)
Current Acct. Bal (1 year lag)	0.002	-0.013	-0.005	0.002	0.000	-0.013	-0.006	0.001
	(0.005)	(0.009)	(0.006)	(0.007)	(0.005)	(0.009)	(0.006)	(0.007)
Ln of Debt to GDP (1 year lag)	0.291***	0.079	0.283***	0.624***	0.277***	0.069	0.251**	0.590***
	(0.073)	(0.140)	(0.109)	(0.120)	(0.073)	(0.141)	(0.109)	(0.120)
GDP Growth, % (1 year lag)	-0.034***	-0.038**	-0.036**	-0.038**	-0.031***	-0.038**	-0.033**	-0.036**
	(0.012)	(0.015)	(0.014)	(0.015)	(0.012)	(0.015)	(0.014)	(0.015)
GDP Per Capita, PPP (1 year lag)	-0.00002***	0.00000102	-0.0000186**	-0.0000202**	-0.0000234***	-0.00000508	-0.0000258***	-0.0000275***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Total Reserves, USD (1 year lag)	0.129***	0.133	0.163***	0.132**	0.136***	0.195	0.194***	0.159***
	(0.029)	(0.122)	(0.054)	(0.058)	(0.030)	(0.129)	(0.056)	(0.059)
Import Cover, Months (1 year lag)	-0.089***	-0.146***	-0.129***	-0.117***	-0.092***	-0.156***	-0.133***	-0.121***
	(0.018)	(0.042)	(0.027)	(0.029)	(0.018)	(0.043)	(0.028)	(0.029)
6-Month Libor	-0.011	-0.065**	-0.025	0.791***	-0.038	-0.071**	-0.054**	0.723***
	(0.022)	(0.032)	(0.026)	(0.186)	(0.024)	(0.032)	(0.028)	(0.188)
Unemployment, %	0.022***	0.126***	0.055***	0.052***	0.020***	0.121***	0.050***	0.049***
	(0.007)	(0.026)	(0.014)	(0.015)	(0.007)	(0.026)	(0.014)	(0.015)
Primary School Enrollment, %	0.008**	0.014**	0.013**	0.014***	0.008**	0.014**	0.013**	0.015***
	(0.003)	(0.007)	(0.005)	(0.005)	(0.003)	(0.007)	(0.005)	(0.006)
Life Expectancy at Birth	-0.013*	-0.097***	-0.034**	-0.023	-0.014*	-0.089***	-0.032**	-0.025*
	(0.007)	(0.029)	(0.014)	(0.015)	(0.007)	(0.030)	(0.014)	(0.015)
Ln of Debt to China, USD (1 year lag)					-0.010*	-0.014	-0.020**	-0.024***
					(0.006)	(0.010)	(0.008)	(0.009)
Debt to China, % GDP (1 year lag)					-0.015	-0.001	-0.008	0.000
					(0.010)	(0.012)	(0.011)	(0.012)
Constant	-5.790***		-6.000***	-11.920***	-5.596***		-6.355***	-11.711***
	(0.832)		(1.446)	(1.847)	(0.838)		(1.455)	(1.863)
Observations	2,717	2,367	2,717	2,717	2,717	2,367	2,717	2,717
Number of Countries	155	128	155	155	155	128	155	155
Country FE	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Random Effects	No	No	Yes	Yes	No	No	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 27. Joint Logistic Regression Output Against 'In Distress' Pre 2009

Model	Pooled Logit (1)	Fixed Effects (2)	Random Effects (3)	Mixed Effects (4)	Pooled Logit (5)	Fixed Effects (6)	Random Effects (7)	Mixed Effects (8)
VARIABLES	In Distress	In Distress	In Distress	In Distress	In Distress	In Distress	In Distress	In Distress
Previous Distress	2.683***	14.976	3.026***	3.121***	2.700***	15.022	3.060***	3.157***
	(0.597)	(741.030)	(0.648)	(0.674)	(0.597)	(743.587)	(0.650)	(0.677)
In Distress (1 year lag)	1.568***	0.537***	1.249***	1.174***	1.571***	0.547***	1.249***	1.186***
	(0.134)	(0.153)	(0.162)	(0.172)	(0.134)	(0.154)	(0.162)	(0.173)
Current Acct. Bal (1 year lag)	-0.002	-0.006	-0.004	0.002	-0.003	-0.007	-0.006	0.001
	(0.009)	(0.011)	(0.009)	(0.011)	(0.009)	(0.011)	(0.009)	(0.011)
Ln of Debt to GDP (1 year lag)	0.160	-0.338	0.144	0.319**	0.159	-0.377	0.127	0.310**
	(0.106)	(0.262)	(0.135)	(0.150)	(0.106)	(0.263)	(0.136)	(0.150)
GDP Growth, % (1 year lag)	0.001	-0.025	-0.003	-0.015	0.004	-0.025	0.000	-0.016
	(0.017)	(0.023)	(0.018)	(0.020)	(0.017)	(0.023)	(0.019)	(0.020)
GDP Per Capita, PPP (1 year lag)	-0.0000238***	0.0000423	-0.0000225**	-0.0000255**	-0.0000248***	0.0000328	-0.0000247**	-0.0000309***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Total Reserves, USD (1 year lag)	0.165***	0.190	0.184***	0.183***	0.161***	0.288	0.186***	0.182***
	(0.045)	(0.187)	(0.058)	(0.065)	(0.045)	(0.199)	(0.059)	(0.065)
Import Cover, Months (1 year lag)	-0.092***	-0.189***	-0.113***	-0.126***	-0.091***	-0.206***	-0.113***	-0.126***
	(0.030)	(0.068)	(0.036)	(0.039)	(0.030)	(0.070)	(0.036)	(0.039)
6-Month Libor	0.020	0.072	0.038	-0.301	0.016	0.066	0.033	-0.405**
	(0.040)	(0.045)	(0.042)	(0.186)	(0.040)	(0.045)	(0.042)	(0.190)
Unemployment, %	0.002	0.078*	0.008	0.014	0.000	0.072	0.006	0.013
	(0.010)	(0.045)	(0.014)	(0.016)	(0.010)	(0.045)	(0.014)	(0.016)
Primary School Enrollment, %	0.014***	0.005	0.015**	0.017**	0.014***	0.006	0.015**	0.016**
	(0.005)	(0.011)	(0.006)	(0.007)	(0.005)	(0.011)	(0.006)	(0.007)
Life Expectancy at Birth	-0.015	-0.104**	-0.022	-0.023	-0.015	-0.093*	-0.023	-0.024
	(0.010)	(0.049)	(0.014)	(0.016)	(0.011)	(0.050)	(0.014)	(0.016)
Ln of Debt to China, USD (1 year lag)					-0.003	-0.019	-0.009	-0.019
					(0.011)	(0.016)	(0.013)	(0.014)
Debt to China, % GDP (1 year lag)					-0.094	-0.050	-0.085	-0.139*
					(0.061)	(0.068)	(0.065)	(0.075)
Constant	-7.930***		-8.154***	-6.489***	-7.771***		-8.014***	-5.650***
	(1.293)		(1.637)	(1.927)	(1.294)		(1.642)	(1.952)
Observations	1,458	1,131	1,458	1,458	1,458	1,131	1,458	1,458
Number of Countries	141	102	141	141	141	102	141	141
Country FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Year FE	No	No	No	Yes	No	No	No	Yes
Random Effects	No	No	Yes	Yes	No	No	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 28. Joint Logistic Regression Output Against 'In Distress' Post 2009

Model	Pooled Logit (1)	Fixed Effects (2)	Random Effects (3)	Mixed Effects (4)	Pooled Logit (5)	Fixed Effects (6)	Random Effects (7)	Mixed Effects (8)
VARIABLES	In Distress	In Distress	In Distress	In Distress	In Distress	In Distress	In Distress	In Distress
Previous Distress	1.020***	-1.753	1.132***	1.148***	1.027***	-1.787	1.142***	1.147***
	(0.326)	(1.176)	(0.405)	(0.426)	(0.327)	(1.176)	(0.405)	(0.425)
In Distress (1 year lag)	1.341***	0.127	0.996***	0.878***	1.332***	0.124	0.987***	0.879***
	(0.140)	(0.163)	(0.174)	(0.176)	(0.140)	(0.163)	(0.174)	(0.176)
Current Acct. Bal (1 year lag)	-0.008	-0.023*	-0.013	-0.012	-0.008	-0.023	-0.013	-0.012
	(0.009)	(0.014)	(0.011)	(0.011)	(0.009)	(0.014)	(0.011)	(0.011)
Ln of Debt to GDP (1 year lag)	0.306**	0.704**	0.363**	0.474***	0.313**	0.740**	0.371**	0.476***
	(0.127)	(0.336)	(0.163)	(0.179)	(0.127)	(0.340)	(0.163)	(0.178)
GDP Growth, % (1 year lag)	-0.030	0.008	-0.030	-0.028	-0.030	0.008	-0.030	-0.028
	(0.019)	(0.027)	(0.021)	(0.022)	(0.019)	(0.027)	(0.021)	(0.022)
GDP Per Capita, PPP (1 year lag)	-0.00000704	-0.0002099**	-0.00000871	-0.0000143	-0.00000571	-0.000213**	-0.00000873	-0.0000123
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Total Reserves, USD (1 year lag)	0.063	-0.099	0.094	0.091	0.045	-0.061	0.080	0.077
	(0.044)	(0.354)	(0.061)	(0.064)	(0.047)	(0.359)	(0.064)	(0.067)
Import Cover, Months (1 year lag)	-0.046*	0.002	-0.056*	-0.052	-0.046*	-0.005	-0.056*	-0.051
	(0.024)	(0.087)	(0.031)	(0.032)	(0.024)	(0.088)	(0.031)	(0.032)
6-Month Libor	-0.873***	-0.840***	-0.960***	-0.739***	-0.875***	-0.843***	-0.957***	-0.739***
	(0.142)	(0.172)	(0.150)	(0.165)	(0.142)	(0.172)	(0.150)	(0.165)
Unemployment, %	0.026**	0.131*	0.037**	0.040**	0.025**	0.129*	0.035**	0.040**
	(0.012)	(0.070)	(0.017)	(0.018)	(0.012)	(0.070)	(0.017)	(0.018)
Primary School Enrollment, %	0.000	0.001	0.001	-0.001	-0.001	0.002	-0.001	-0.002
	(0.006)	(0.021)	(0.008)	(0.009)	(0.006)	(0.021)	(0.008)	(0.009)
Life Expectancy at Birth	-0.013	-0.083	-0.020	-0.014	-0.012	-0.070	-0.020	-0.012
	(0.013)	(0.079)	(0.018)	(0.019)	(0.013)	(0.081)	(0.018)	(0.019)
Country				-0.000				-0.000
				(0.000)				(0.000)
Year				-0.114***				-0.115***
				(0.032)				(0.033)
Ln of Debt to China, USD (1 year lag)					0.007	-0.018	0.003	0.008
					(0.009)	(0.030)	(0.012)	(0.013)
Debt to China, % GDP (1 year lag)					-0.011	-0.006	-0.013	-0.005
					(0.011)	(0.019)	(0.013)	(0.013)
Constant	-3.000**		-3.450*	225.359***	-2.678*		-3.072	227.435***
	(1.395)		(1.887)	(63.868)	(1.433)		(1.921)	(65.531)
Observations	1,259	949	1,259	1,259	1,259	949	1,259	1,259
Number of Countries	151	108	151	151	151	108	151	151
Country FE	No	YES	No	YES	No	YES	No	YES
Year FE	No	YES	No	YES	No	YES	No	YES
Random Effects	No	No	Yes	YES	No	No	Yes	YES

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Figure 29. Joint Logistic Regression Output Against 'Start of Distress' Pre 2009

	Pooled Logit	Fixed Effects	Random Effects	Mixed Effects	Pooled Logit	Fixed Effects	Random Effects	Mixed Effects
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Start of Distress	Start of Distress	Start of Distress	Start of Distress	Start of Distress	Start of Distress	Start of Distress	Start of Distress
Previous Distress?	3.068***	15.412	3.728***	3.809***	3.080***	15.450	3.776***	3.839***
	(0.593)	(832.006)	(0.727)	(0.756)	(0.593)	(830.057)	(0.730)	(0.760)
Current Acct. Bal (1 year lag)	0.005	-0.003	-0.001	0.007	0.005	-0.003	-0.002	0.006
	(0.009)	(0.011)	(0.010)	(0.011)	(0.009)	(0.011)	(0.010)	(0.011)
Ln of Debt to GDP (1 year lag)	0.248**	-0.359	0.140	0.382**	0.245**	-0.397	0.102	0.360**
	(0.100)	(0.260)	(0.161)	(0.176)	(0.100)	(0.261)	(0.163)	(0.176)
GDP Growth, % (1 year lag)	-0.018	-0.031	-0.020	-0.028	-0.013	-0.031	-0.016	-0.029
	(0.016)	(0.022)	(0.019)	(0.021)	(0.016)	(0.022)	(0.020)	(0.021)
GDP Per Capita, PPP (1 year lag)	-0.0000384***	0.0000314	-0.0000295**	-0.00003**	-0.0000402***	0.0000222	-0.0000337***	-0.000038***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Total Reserves, USD (1 year lag)	0.198***	0.199	0.218***	0.213***	0.200***	0.297	0.235***	0.225***
	(0.042)	(0.185)	(0.073)	(0.080)	(0.042)	(0.196)	(0.074)	(0.080)
Import Cover, Months (1 year lag)	-0.112***	-0.203***	-0.157***	-0.163***	-0.110***	-0.219***	-0.156***	-0.163***
	(0.029)	(0.067)	(0.042)	(0.044)	(0.029)	(0.068)	(0.042)	(0.044)
6-Month Libor	0.062*	0.087**	0.082*	-0.175	0.052	0.081*	0.071*	-0.293
	(0.037)	(0.044)	(0.042)	(0.190)	(0.037)	(0.044)	(0.043)	(0.195)
Unemployment, %	0.006	0.094**	0.023	0.028	0.004	0.089**	0.020	0.027
	(0.009)	(0.044)	(0.018)	(0.020)	(0.009)	(0.045)	(0.018)	(0.020)
Primary School Enrollment, %	0.016***	0.004	0.014*	0.018**	0.016***	0.005	0.014**	0.018**
	(0.004)	(0.011)	(0.007)	(0.008)	(0.004)	(0.011)	(0.007)	(0.008)
Life Expectancy at Birth	-0.012	-0.110**	-0.029	-0.030	-0.014	-0.099**	-0.031*	-0.031
	(0.010)	(0.049)	(0.018)	(0.020)	(0.010)	(0.049)	(0.018)	(0.020)
Ln of Debt to China, USD (1 year lag)					-0.012	-0.021	-0.021	-0.028*
					(0.010)	(0.016)	(0.013)	(0.015)
Debt to China, % GDP (1 year lag)					-0.060	-0.027	-0.047	-0.115
					(0.057)	(0.065)	(0.065)	(0.074)
Constant	-8.900***		-8.435***	-7.465***	-8.735***		-8.485***	-6.739***
	(1.242)		(2.013)	(2.298)	(1.244)		(2.015)	(2.312)
Observations	1,458	1,131	1,458	1,458	1,458	1,131	1,458	1,458
Number of Countries	141	102	141	141	141	102	141	141
Country FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Year FE	No	No	No	Yes	No	No	No	Yes
Random Effects	No	No	Yes	Yes	No	No	Yes	Yes

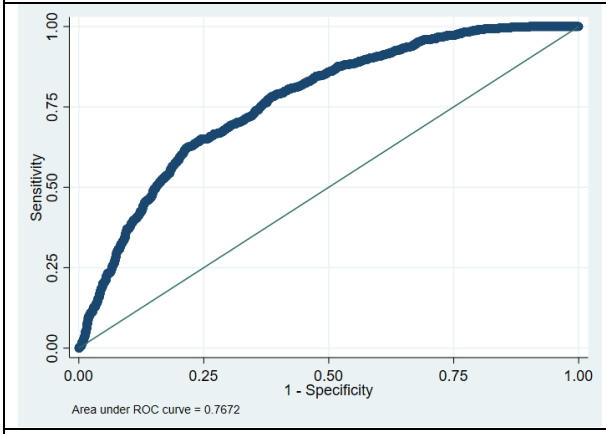
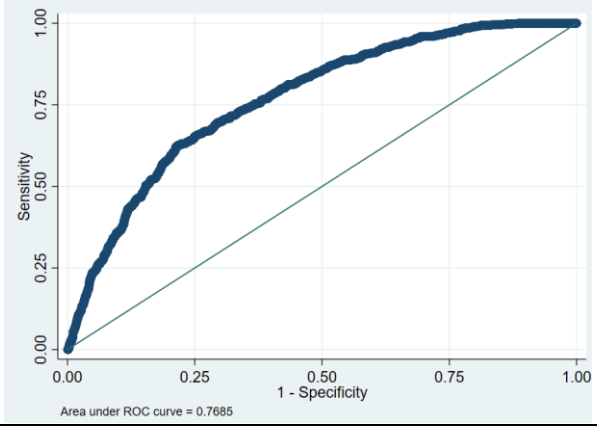
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 30. Joint Logistic Regression Output Against 'Start of Distress' Post 2009

	Pooled Logit	Fixed Effects	Random Effects	Mixed Effects	Pooled Logit	Fixed Effects	Random Effects	Mixed Effects
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Start of Distress	Start of Distress	Start of Distress	Start of Distress	Start of Distress	Start of Distress	Start of Distress	Start of Distress
Previous Distress?	1.421***	-1.751	1.396***	1.445***	1.423***	-1.770	1.405***	1.441***
	(0.317)	(1.174)	(0.481)	(0.493)	(0.318)	(1.176)	(0.481)	(0.492)
Current Acct. Bal (1 year lag)	-0.007	-0.023*	-0.017	-0.012	-0.007	-0.023*	-0.017	-0.012
	(0.009)	(0.014)	(0.012)	(0.012)	(0.009)	(0.014)	(0.012)	(0.012)
Ln of Debt to GDP (1 year lag)	0.375***	0.721**	0.463**	0.666***	0.385***	0.736**	0.476**	0.667***
	(0.123)	(0.335)	(0.190)	(0.202)	(0.123)	(0.338)	(0.190)	(0.202)
GDP Growth, % (1 year lag)	-0.048**	0.008	-0.039*	-0.037	-0.048**	0.008	-0.039*	-0.038
	(0.019)	(0.027)	(0.022)	(0.025)	(0.019)	(0.027)	(0.022)	(0.025)
GDP Per Capita, PPP (1 year lag)	-0.0000062	-0.0002134**	-0.0000105	-0.0000164	-0.00000466	-0.0002164**	-0.0000113	-0.0000146
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Total Reserves, USD (1 year lag)	0.087**	-0.110	0.130*	0.134*	0.060	-0.082	0.112	0.120
	(0.042)	(0.353)	(0.075)	(0.078)	(0.045)	(0.363)	(0.078)	(0.081)
Import Cover, Months (1 year lag)	-0.064***	0.002	-0.071*	-0.067*	-0.064***	-0.005	-0.072*	-0.067*
	(0.024)	(0.086)	(0.037)	(0.038)	(0.024)	(0.088)	(0.037)	(0.038)
6-Month Libor	-0.895***	-0.846***	-1.055***	-2.204***	-0.896***	-0.844***	-1.049***	-2.206***
	(0.134)	(0.172)	(0.151)	(0.374)	(0.134)	(0.172)	(0.151)	(0.377)
Unemployment, %	0.035***	0.139**	0.057***	0.054**	0.033***	0.138**	0.053**	0.053**
	(0.012)	(0.069)	(0.021)	(0.021)	(0.012)	(0.069)	(0.021)	(0.021)
Primary School Enrollment, %	0.000	0.001	0.002	0.001	-0.002	0.002	0.000	0.000
	(0.006)	(0.021)	(0.010)	(0.010)	(0.006)	(0.021)	(0.010)	(0.010)
Life Expectancy at Birth	-0.019	-0.084	-0.030	-0.016	-0.017	-0.076	-0.029	-0.013
					(0.013)	(0.081)	(0.023)	(0.023)
Ln of Debt to China, USD (1 year lag)					0.010	0.000	0.003	0.008
					(0.009)	(0.025)	(0.014)	(0.015)
Debt to China, % GDP (1 year lag)					-0.018*	-0.008	-0.018	-0.007
	(0.013)	(0.079)	(0.022)	(0.023)	(0.011)	(0.019)	(0.015)	(0.014)
Constant	-3.122**		-3.887*	-3.536	-2.581*		-3.395	-3.408
	(1.337)		(2.312)	(2.444)	(1.375)		(2.333)	(2.463)
Observations	1,259	949	1,259	1,259	1,259	949	1,259	1,259
Number of Countries	151	108	151	151	151	108	151	151
Country FE	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Random Effects	No	No	Yes	Yes	No	No	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 31. Area Under the Receiver Operating Characteristic Curve (AUC); 1970-2020 with and without Chinese Lending, against 'In Distress'

Pooled Logitistic Model, 1970-2020	Pooled Logitistic Model, 1970-2020 with Chinese Lending
	
AUC: 76.72%	AUC: 76.85%

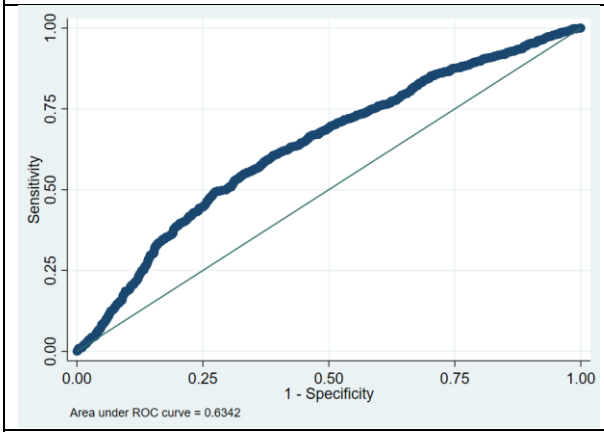
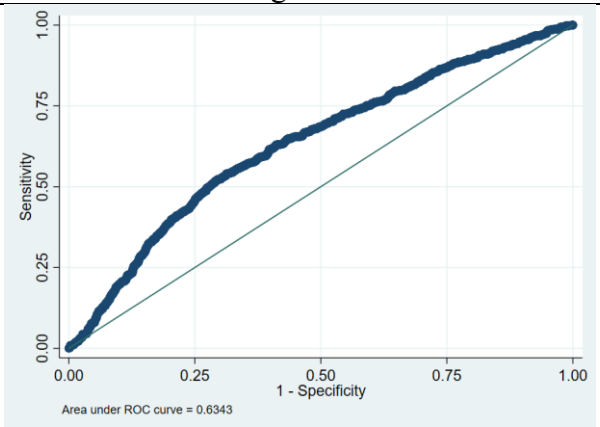
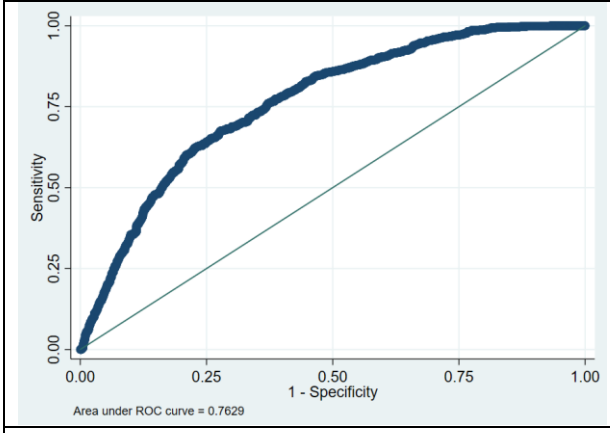
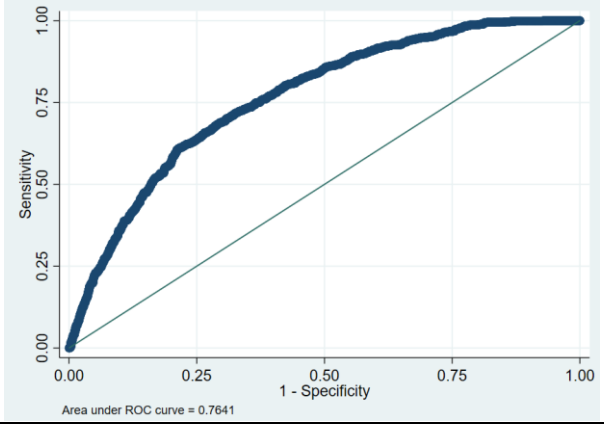
Fixed Effects Logitistic Model, 1970-2020	Fixed Effects Logitistic Model, 1970-2020 with Chinese Lending
	
AUC: 63.42%	AUC: 63.43%

Figure 32. Area Under the Receiver Operating Characteristic Curve (AUC); 1970-2020 with and without Chinese Lending, against 'In Distress'

Random Effects Logitistic Model, 1970-2020	Random Effects Logitistic Model, 1970-2020 with Chinese Lending
	
AUC: 76.29%	AUC: 76.41%

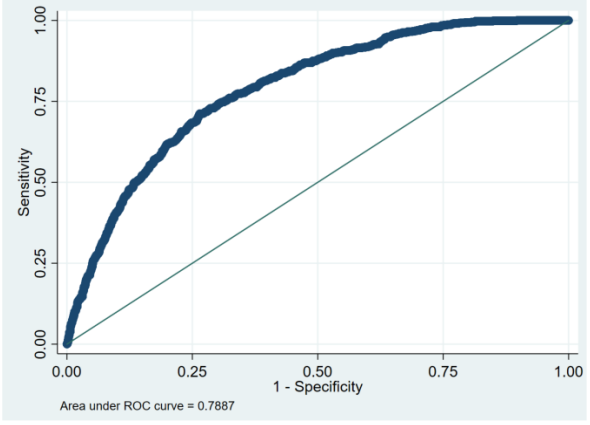
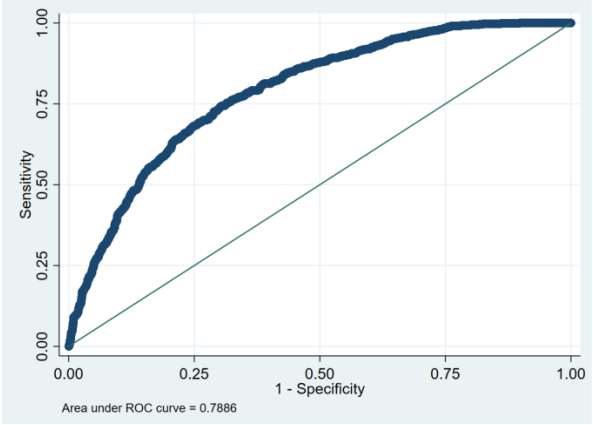
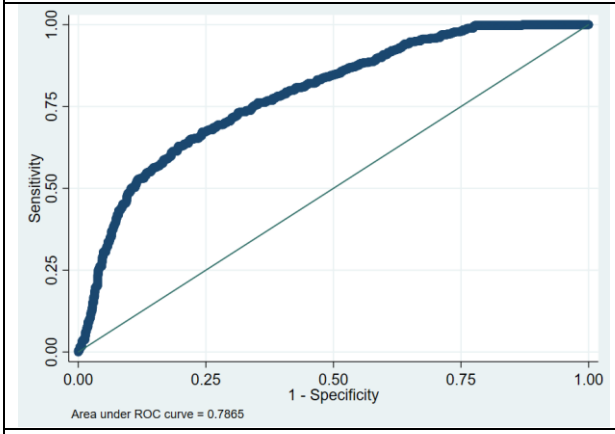
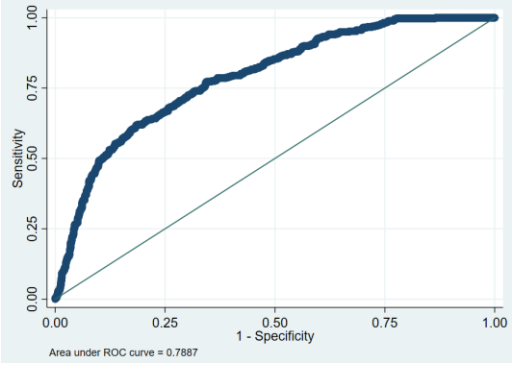
Mixed Effects Logitistic Model, 1970-2020	Mixed Effects Logitistic Model, 1970-2020 with Chinese Lending
	
AUC: 78.87%	AUC: 78.86%

Figure 33. Area Under the Receiver Operating Characteristic Curve (AUC); 1970-2008 with and without Chinese Lending, against 'In Distress'

Pooled Logitistic Model, 1970-2008	Pooled Logitistic Model, 1970-2008 with Chinese Lending
	
AUC: 78.65%	AUC: 78.87%

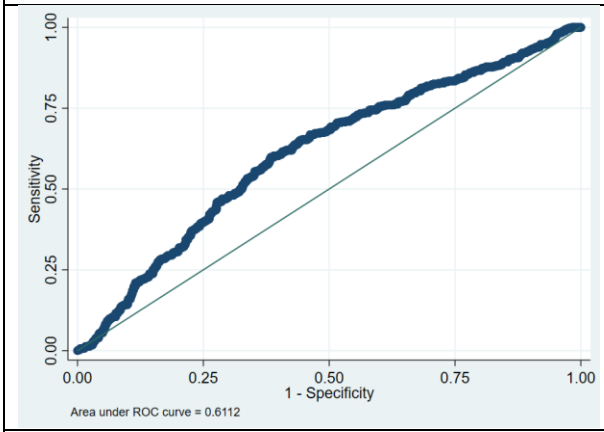
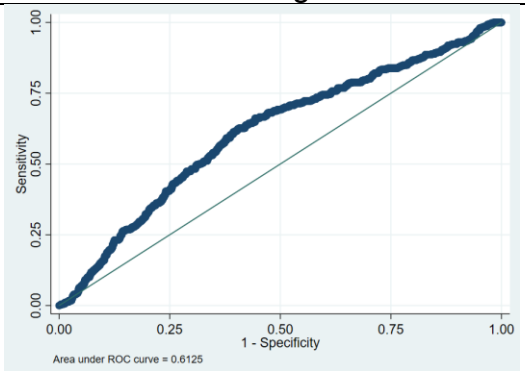
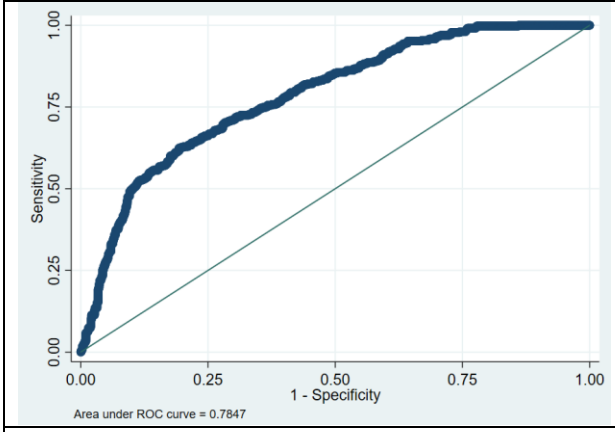
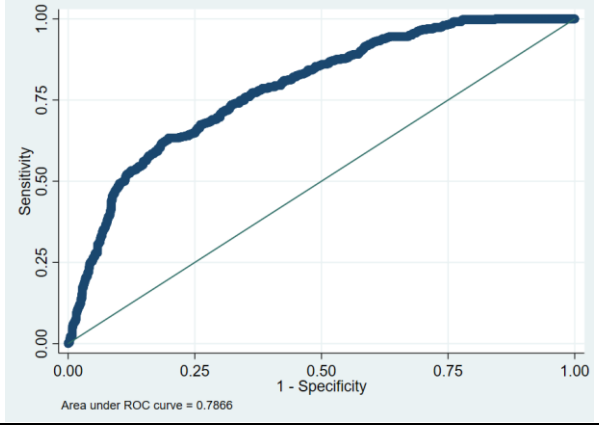
Fixed Effects Logitistic Model, 1970-2008	Fixed Effects Logitistic Model, 1970-2008 with Chinese Lending
	
AUC: 61.12%	AUC: 61.25%

Figure 34. Area Under the Receiver Operating Characteristic Curve (AUC); 1970-2008 with and without Chinese Lending, against 'In Distress'

Random Effects Logitistic Model, 1970-2008	Random Effects Logitistic Model, 1970-2008 with Chinese Lending
	
AUC: 78.47%	AUC: 78.66%

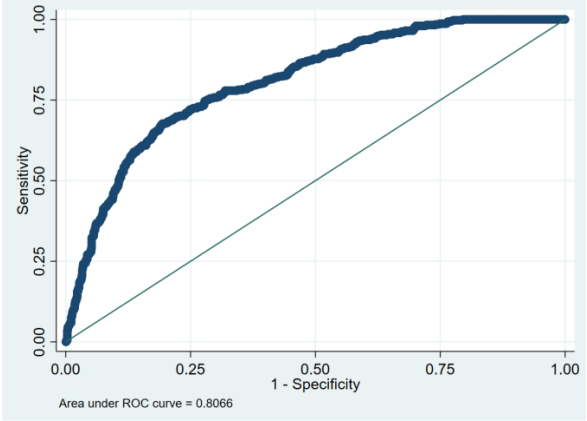
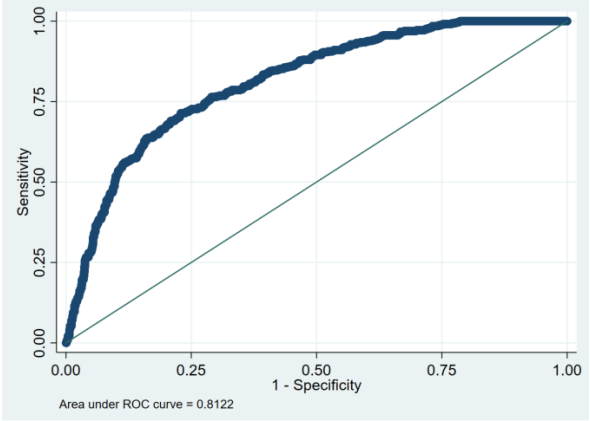
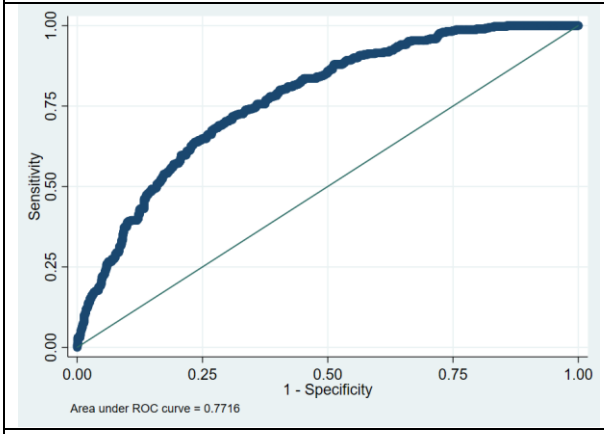
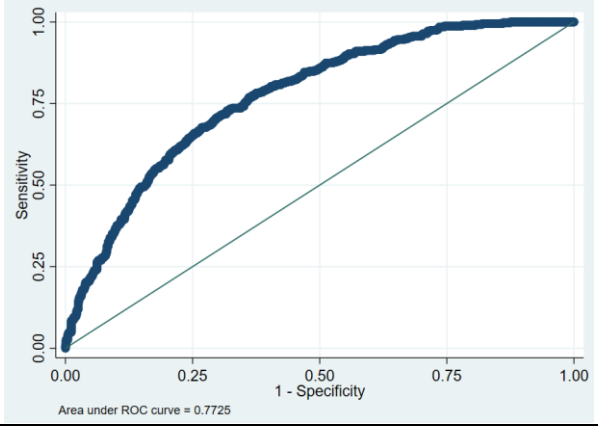
Mixed Effects Logitistic Model, 1970-2008	Mixed Effects Logitistic Model, 1970-2008 with Chinese Lending
	
AUC: 80.66%	AUC: 81.22%

Figure 35. Area Under the Receiver Operating Characteristic Curve (AUC); 2009-2020 with and without Chinese Lending, against 'In Distress'

Pooled Logitistic Model, 2009-2020	Pooled Logitistic Model, 2009-2020 with Chinese Lending
	
AUC: 77.16%	AUC: 77.25%

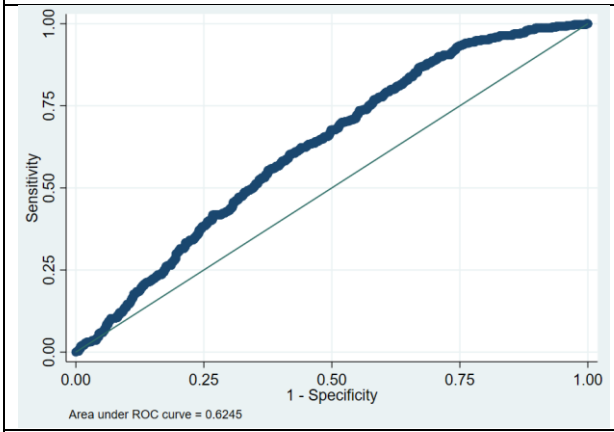
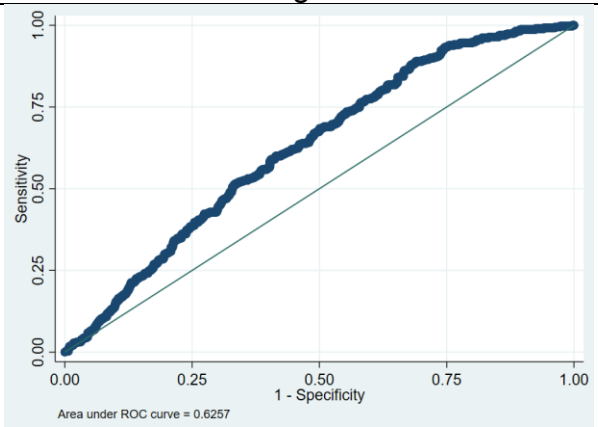
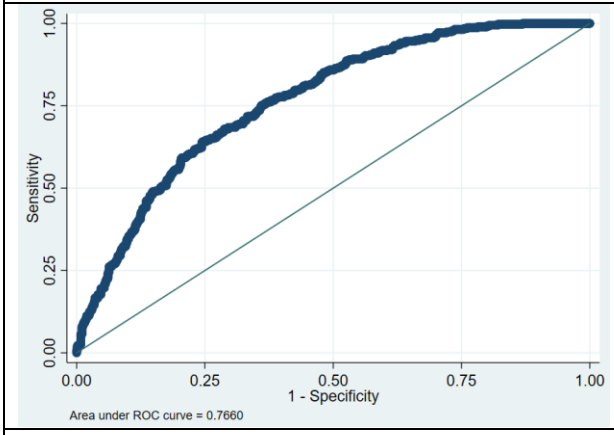
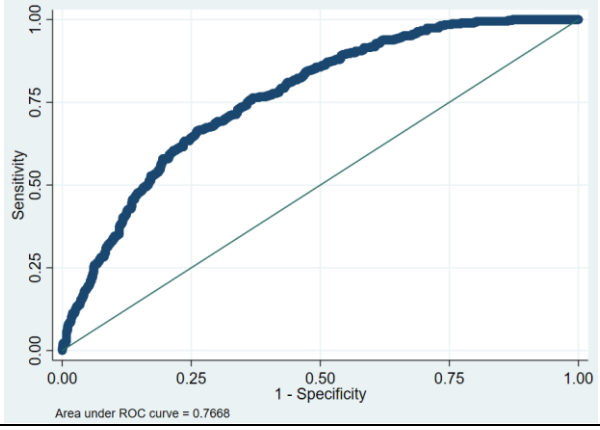
Fixed Effects Logitistic Model, 2009-2020	Fixed Effects Logitistic Model, 2009-2020 with Chinese Lending
	
AUC: 62.45%	AUC: 62.57%

Figure 36. Area Under the Receiver Operating Characteristic Curve (AUC); 2009-2020 with and without Chinese Lending, against 'In Distress'

Random Effects Logitistic Model, 2009-2020	Random Effects Logitistic Model, 2009-2020 with Chinese Lending
	
AUC: 76.60%	AUC: 76.68%

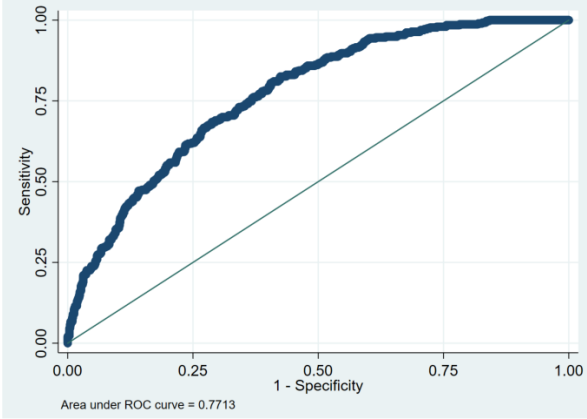
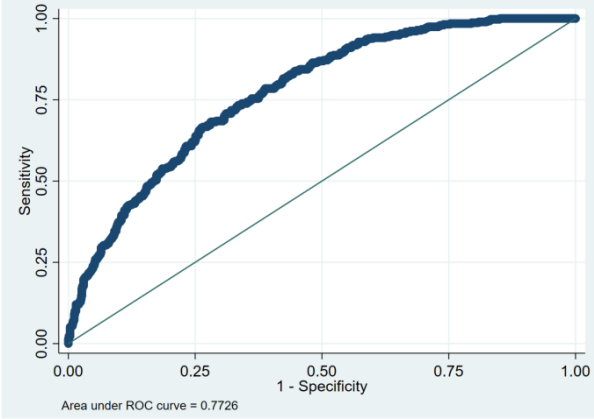
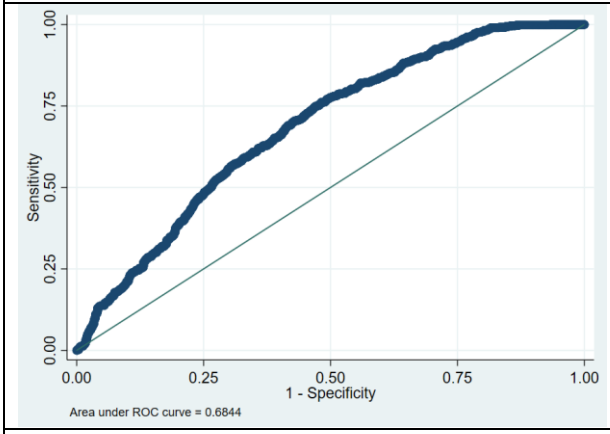
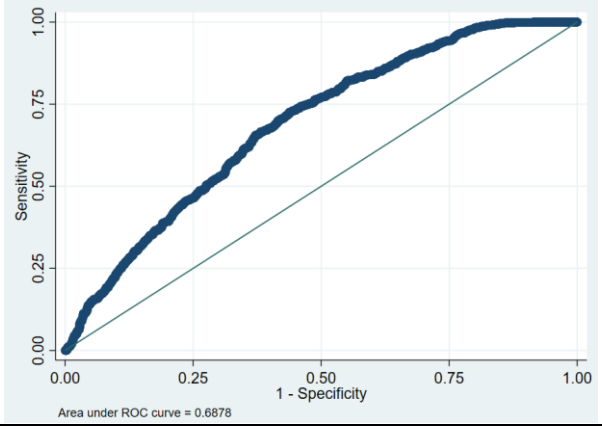
Mixed Effects Logitistic Model, 2009-2020	Mixed Effects Logitistic Model, 2009-2020 with Chinese Lending
	
AUC: 77.13%	AUC: 77.26%

Figure 37. Area Under the Receiver Operating Characteristic Curve (AUC); 1970-2020 with and without Chinese Lending, against 'Start of Distress'

Pooled Logitistic Model, 1970-2020	Pooled Logitistic Model, 1970-2020 with Chinese Lending
	
AUC: 68.44%	AUC: 68.78%

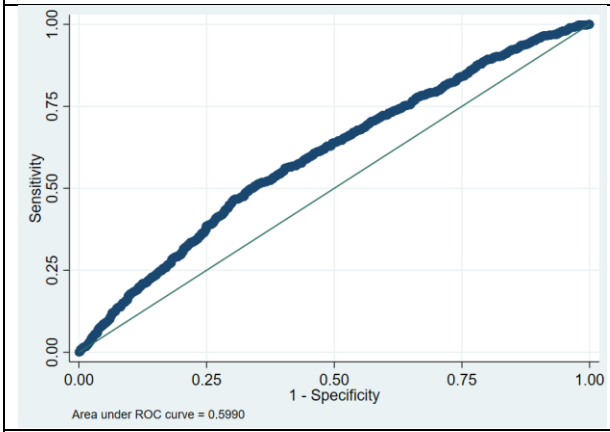
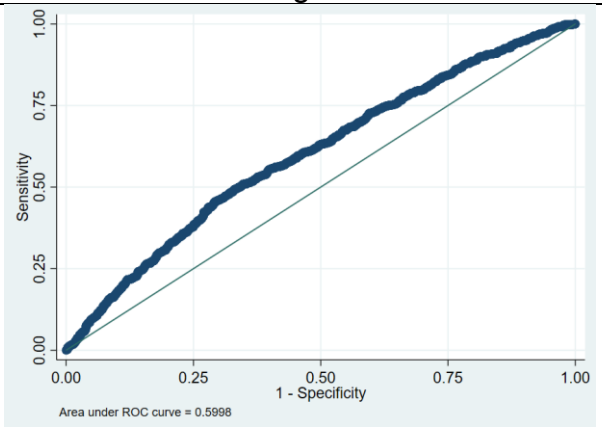
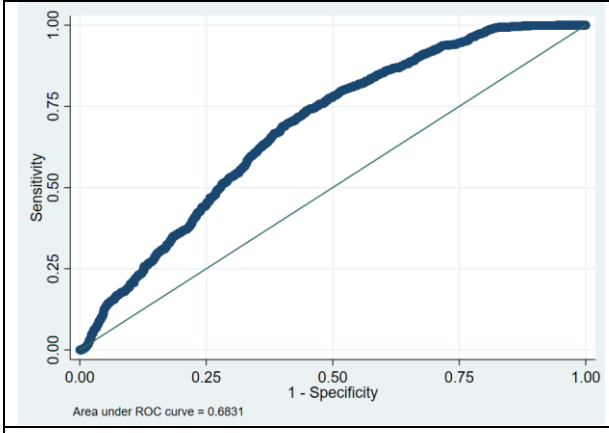
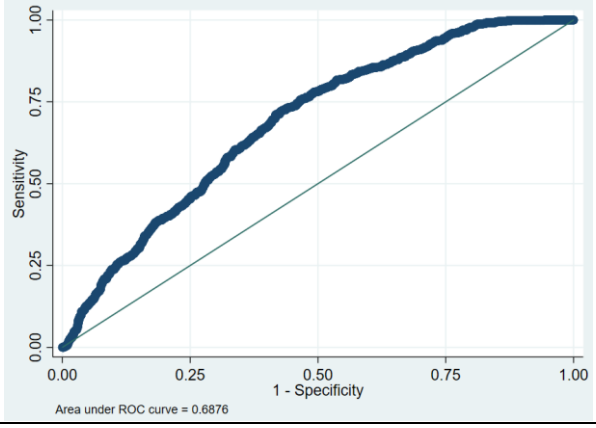
Fixed Effects Logitistic Model, 1970-2020	Fixed Effects Logitistic Model, 1970-2020 with Chinese Lending
	
AUC: 59.90%	AUC: 59.98%

Figure 38. Area Under the Receiver Operating Characteristic Curve (AUC); 1970-2020 with and without Chinese Lending, against 'Start of Distress'

Random Effects Logitistic Model, 1970-2020	Random Effects Logitistic Model, 1970-2020 with Chinese Lending
	
AUC: 68.31%	AUC: 68.76%

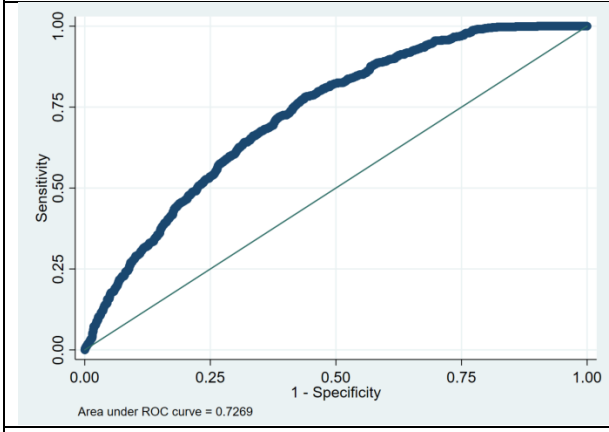
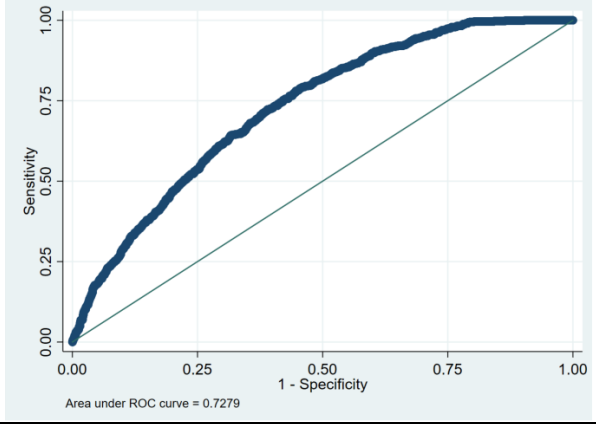
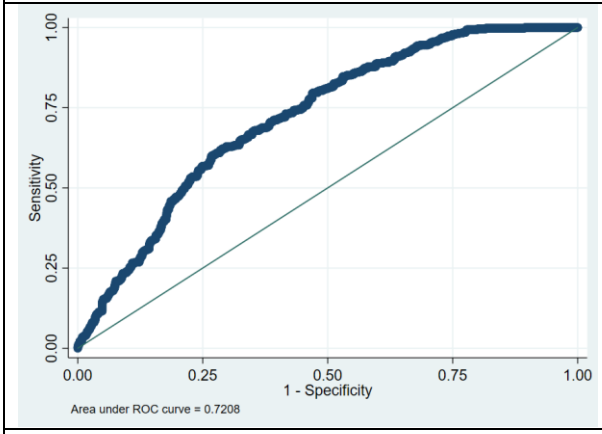
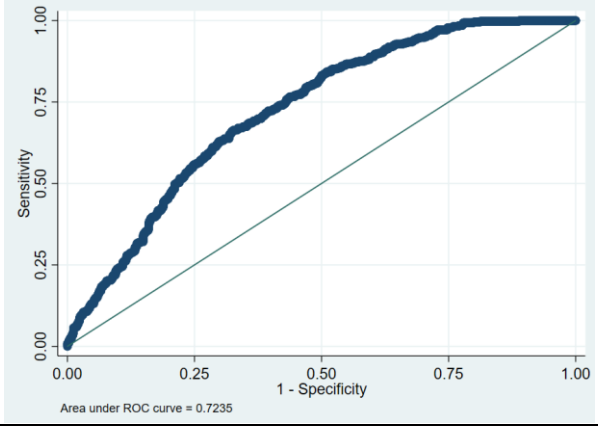
Mixed Effects Logitistic Model, 1970-2020	Mixed Effects Logitistic Model, 1970-2020 with Chinese Lending
	
AUC: 72.69%	AUC: 72.79%

Figure 39. Area Under the Receiver Operating Characteristic Curve (AUC); 1970-2008 with and without Chinese Lending, against 'Start of Distress'

Pooled Logitistic Model, 1970-2008	Pooled Logitistic Model, 1970-2008 with Chinese Lending
	
AUC: 72.08%	AUC: 72.35%

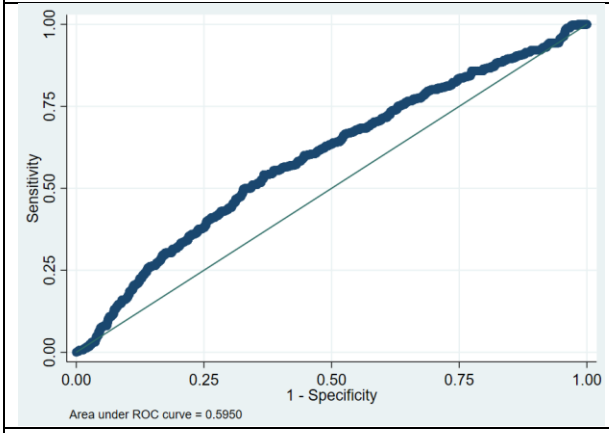
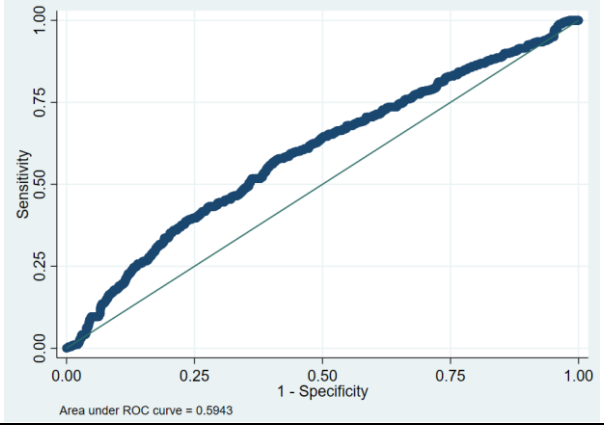
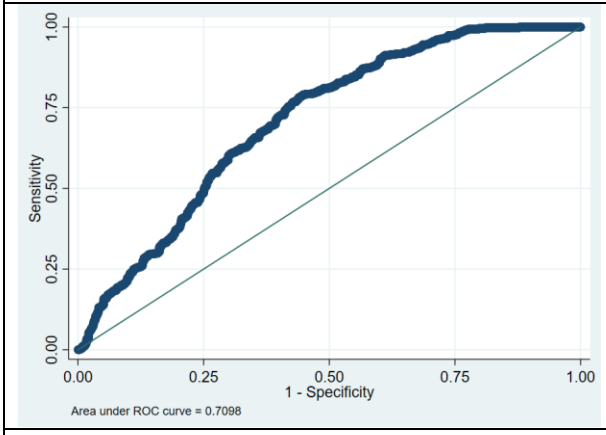
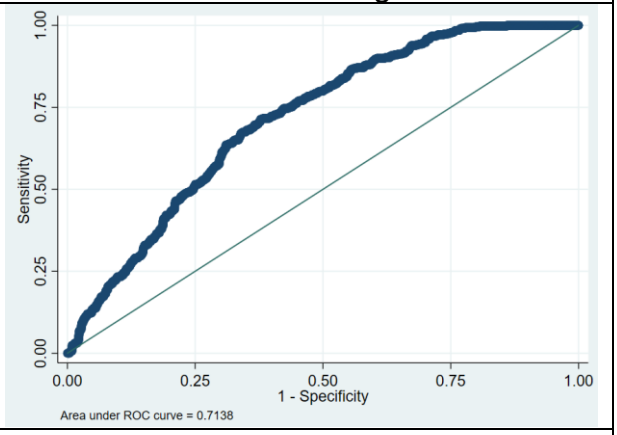
Fixed Effects Logitistic Model, 1970-2020	Fixed Effects Logitistic Model, 1970-2020 with Chinese Lending
	
AUC: 59.50%	AUC: 59.43%

Figure 40. Area Under the Receiver Operating Characteristic Curve (AUC); 1970-2008 with and without Chinese Lending, against 'Start of Distress'

Random Effects Logitistic Model, 1970-2020	Random Effects Logitistic Model, 1970-2020 with Chinese Lending
	
AUC: 70.98%	AUC: 71.38%

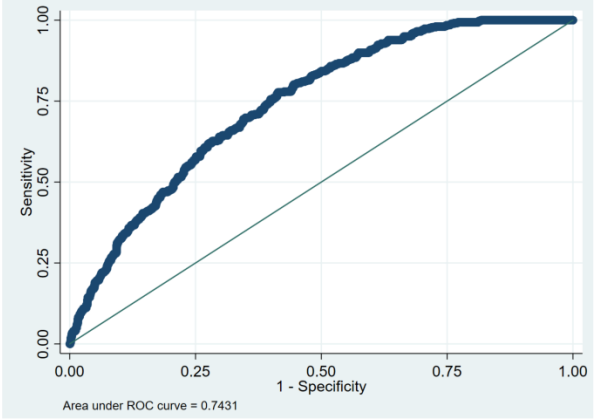
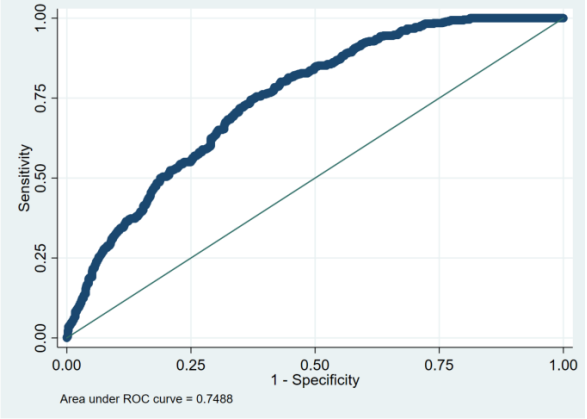
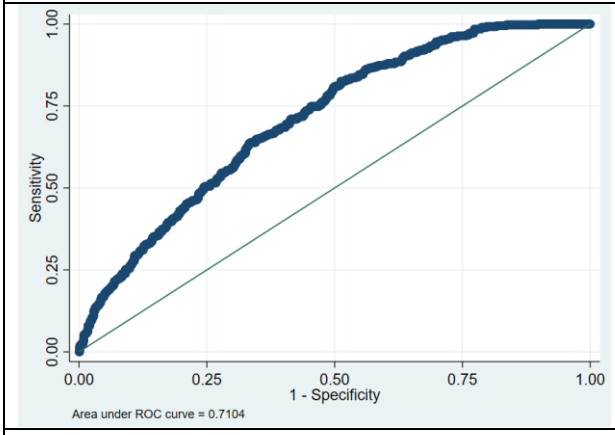
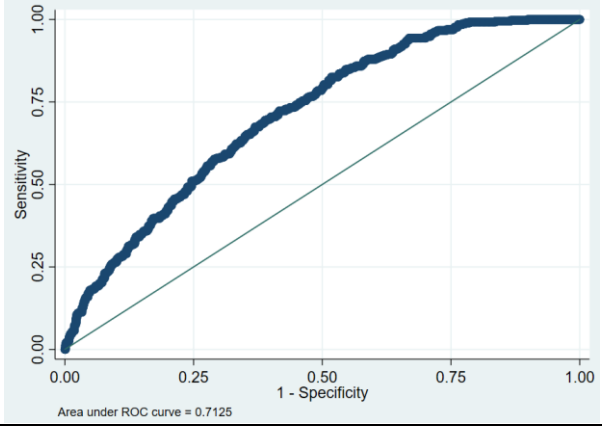
Mixed Effects Logitistic Model, 1970-2020	Mixed Effects Logitistic Model, 1970-2020 with Chinese Lending
	
AUC: 74.31%	AUC: 74.88%

Figure 41. Area Under the Receiver Operating Characteristic Curve (AUC); 2009-2020 with and without Chinese Lending, against 'Start of Distress'

Pooled Logitistic Model, 2009-2020	Pooled Logitistic Model, 2009-2020 with Chinese Lending
	
AUC: 71.04%	AUC: 71.25%

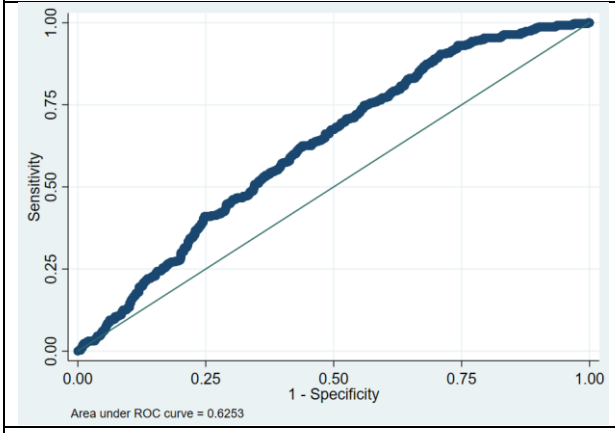
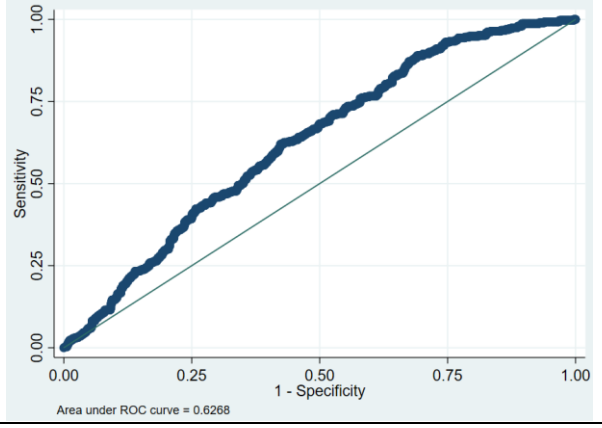
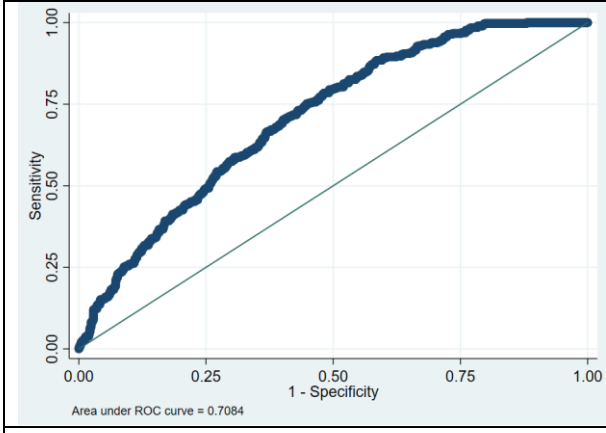
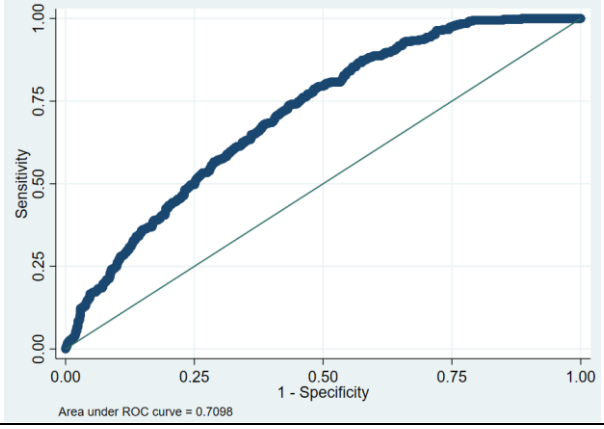
Fixed Effects Logitistic Model, 2009-2020	Fixed Effects Logitistic Model, 2009-2020 with Chinese Lending
	
AUC: 62.53%	AUC: 62.68%

Figure 42. Area Under the Receiver Operating Characteristic Curve (AUC); 2009-2020 with and without Chinese Lending, against 'Start of Distress'

Random Effects Logitistic Model, 2009-2020	Random Effects Logitistic Model, 2009-2020 with Chinese Lending
	
AUC: 70.84%	AUC: 70.98%

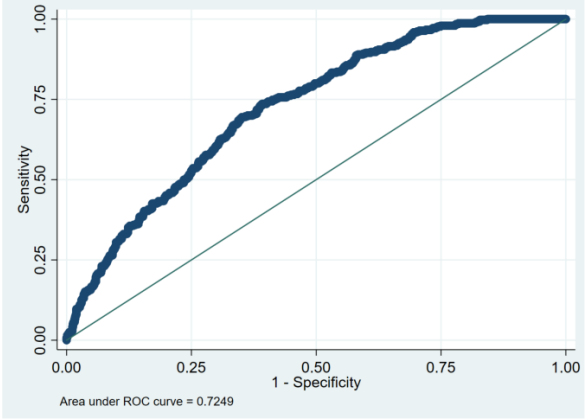
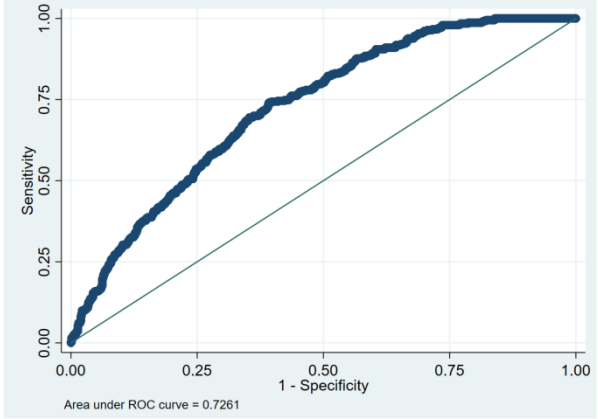
Mixed Effects Logitistic Model, 2009-2020	Mixed Effects Logitistic Model, 2009-2020 with Chinese Lending
	
AUC: 72.49%	72.61%

Table 11. List of BRI Recipient Countries Rated Below Investment Grade

Afghanistan
Albania
Armenia
Belarus
Bhutan
Bosnia
Cambodia
Djibouti
Egypt
Ethiopia
Herzegovina
Iran
Iraq
Jordan
Kenya
Kyrgyzstan
Laos
Lebanon
Maldives
Moldova
Mongolia
Montenegro
Myanmar
Nepal
Pakistan
Sri Lanka
Syria
Tajikistan
Timor-Leste
Turkmenistan
Ukraine
Uzbekistan
Yemen

Source: Center for Global Development (Hurley, Morris, and Portelance 2019)

Table 12. List of IMF Low-Income Countries (PRGT Eligible), as of January 31, 2021

Country	Risk of debt distress 1/	Country	Risk of debt distress 1/
Afghanistan	High	Maldives	High
Bangladesh	Low	Mali	Moderate
Benin	Moderate	Marshall Islands	High
Bhutan	Moderate	Mauritania	High
Burkina Faso	Moderate	Micronesia	High
Burundi	High	Moldova 3/	Low
Cambodia	Low	Mozambique	In debt distress
Cameroon 3/	High	Myanmar	Low
Cabo Verde 3/	High	Nepal	Low
Central African Republic	High	Nicaragua	Moderate
Chad	High	Niger	Moderate
Comoros	Moderate	Papua New Guinea 3/	High
Congo, Democratic Republic of	Moderate	Rwanda	Moderate
Congo, Republic of 3/	In debt distress	Samoa	High
Côte d'Ivoire	Moderate	São Tomé and Príncipe	In debt distress
Djibouti	High	Senegal	Moderate
Dominica 3/	High	Sierra Leone	High
Eritrea	…	Solomon Islands	Moderate
Ethiopia	High	Somalia	In debt distress
Gambia, The	High	South Sudan	High
Ghana	High	St. Lucia 3/ 4/	Moderate
Grenada 3/	In debt distress	St. Vincent and the Grenadines 3/	High
Guinea	Moderate	Sudan	In debt distress
Guinea-Bissau	Moderate	Tajikistan	High
Guyana	Moderate	Tanzania	Low
Haiti	High	Timor Leste 3/	Low
Honduras	Low	Togo	Moderate
Kenya	High	Tonga	High
Kiribati	High	Tuvalu	High
Kyrgyz Republic	Moderate	Uganda	Low
Lao P.D.R.	High	Uzbekistan 3/	Low
Lesotho	Moderate	Vanuatu	Moderate
Liberia	Moderate	Yemen, Republic of	Moderate
Madagascar	Low	Zambia	High
Malawi	Moderate	Zimbabwe 3/	In debt distress

*/ While there is no binding minimum concessionality requirement in the absence of a Fund-supported program, concessional flows remain the most

1/ As of January 31, 2021 and based on the most recently published data, 7 countries are in debt distress, 28 countries are at high risk, 23 countries are at

2/ May reflect usual lags in the publication. Includes DSAs presented to the Executive Board on lapse of time basis.

3/ PRGT-eligible IDA-blend countries.

4/ A market-access countries (MACs) DSA has been completed and published within the past 24 months.

Source: IMF 2021d.

Table 13. List of DSSI Eligible Countries

Country4	DSSI Participation?5	Risk of external debt distress2	Risk of overall debt distress2	Date of DSA Publication	Potential DSSI Savings May-December 2020, % of GDP	USD millions	Potential DSSI Savings January-June 2021, % of GDP	USD millions
Afghanistan	Yes5	High	High	11/20/2021	0.2	39.3	0.2	36.7
Angola3	Yes5	…	…		1.9	1734.9	1.4	1292.8
Bangladesh	No	Low	Low	5/20/2021	0.1	331.9	0.1	290.8
Benin	No	Moderate	Moderate	12/20/2021	0.1	16.1	0.1	15.2
Bhutan	No	Moderate	…	10/18/2021	5.8	145.4	9.9	248.2
Burkina Faso	Yes5	Moderate	Moderate	11/20/2021	0.2	24.2	0.1	12.7
Burundi	Yes	High	…	3/15/2021	0.1	4.5	0.1	2.8
Cabo Verde	Yes5	High	High	10/20/2021	0.9	18	0.8	15.8
Cambodia	No	Low	Low	12/19/2021	0.8	219.2	0.8	209.2
Cameroon	Yes5	High	High	10/20/2021	0.9	337.3	0.7	271.9
Central African Republic	Yes5	High	High	4/20/2021	0.3	7.4	0.4	8.7
Chad	Yes5	High	High	7/20/2021	0.6	65.4	0.4	43.9
Comoros	Yes5	Moderate	Moderate	4/20/2021	0.2	2.3	0.2	1.9
Congo, Dem. Rep.	Yes5	Moderate	Moderate	4/20/2021	0.3	156.3	0.2	105.9
Congo, Rep.	Yes5	In distress	In distress	1/20/2021	1.4	181.8	1.5	190.5
Côte d'Ivoire	Yes5	Moderate	Moderate	12/20/2021	0.4	224	0.1	67.7
Djibouti	Yes5	High	High	5/20/2021	1.7	56.8	2	66.7
Dominica	Yes5	High	…	6/18/2021	0.7	4.3	0.6	3.7
Ethiopia	Yes5	High	High	4/20/2021	0.5	472.9	0.4	359.6
Fiji3	Yes	…	…		0.2	13.4	0.2	13.3
Gambia, The	Yes5	High	High	4/20/2021	0.6	10.2	0.4	6.4
Ghana	No	High	High	4/20/2021	0.6	377.9	0.3	180.2
Grenada	Yes	In distress	In distress	4/20/2021	0.7	8	0.4	5.1
Guinea	Yes5	Moderate	Moderate	12/20/2021	0.5	70.6	0.2	29.2
Guinea-Bissau	Yes	Moderate	…	6/18/2021	0.1	2.1	0.1	1.7
Guyana	No	Moderate	Moderate	8/19/2021	0.3	16.9	0.3	13.6
Haiti	No	High	High	4/20/2021	0.9	76.2	0.7	59.6
Honduras	No	Low	Low	6/20/2021	0.4	102	0.1	27.5
Kenya	Yes	High	High	5/20/2021	0.7	630.8	0.7	620.3
Kiribati	No	High	High	1/19/2021				
Kosovo3	No	…	…		0.1	7.5	0	3.9
Kyrgyz Republic	No	Moderate	Moderate	3/20/2021	0.6	52.1	0.6	49.5
Lao PDR	No	High	High	8/19/2021	1.7	315	1.5	277.6
Lesotho	Yes5	Moderate	Moderate	7/20/2021	0.4	9.8	0.2	5.9
Liberia	No	Moderate	High	12/20/2021	0.1	2.3	0.1	2.2
Madagascar	Yes5	Moderate	Moderate	7/20/2021	0.3	35.5	0.1	8.5
Malawi	Yes5	Moderate	High	10/20/2021	0.2	17.4	0.2	16.7
Maldives	Yes5	High	High	4/20/2021	0.9	50.7	1.1	61.3
Mali	Yes5	Moderate	Moderate	4/20/2021	0.5	82.5	0.3	46.3
Marshall Islands	No	High	…	9/18/2021				
Mauritania	Yes5	High	High	9/20/2021	1.2	90.8	1.3	102.5
Micronesia	No	High	High	8/19/2021				
Moldova	No	Low	Low	4/20/2021	0.2	23.2	0.2	19.9
Mongolia3	No	…	…		0.5	69.9	0.4	60.4
Mozambique	Yes5	In distress	In distress	4/20/2021	1.9	292.6	1.6	250.2
Myanmar	Yes5	Low	Low	6/20/2021	0.6	379.9	0.5	359.3
Nepal	Yes5	Low	Low	5/20/2021	0.1	24.8	0.1	21.3
Nicaragua	No	Moderate	Moderate	11/20/2021	0.3	33	0.2	20
Niger	Yes5	Moderate	Moderate	10/20/2021	0.2	26	0.2	24
Nigeria3	No	…	…		0	123.5	0	155.2
Pakistan3	Yes5	…	…		1.3	3645.4	0.9	2487.8
Papua New Guinea	Yes5	High	High	6/20/2021	1.3	326.9	0.1	26.3
Rwanda	No	Moderate	Moderate	12/20/2021	0.1	13.2	0.1	11.7
Samoa	Yes5	High	High	4/20/2021	1.1	9.5	1	8.4
Sao Tome and Principe	Yes5	In distress	In distress	7/20/2021	0.4	1.6	0.7	2.8
Senegal	Yes5	Moderate	Moderate	4/20/2021	0.6	139.2	0.4	97.7
Sierra Leone	Yes5	High	High	6/20/2021	0.2	8.1	0.2	6.9
Solomon Islands	No	Moderate	Moderate	6/20/2021	0.1	1.5	0	0.7
Somalia	No	In distress	In distress	11/20/2021	0	1.7	0	1.4
South Sudan	No	High	High	11/20/2021				
St. Lucia3	Yes5	…	…		0.2	5.2	0.1	3.1
St. Vincent and the Grenadines	Yes	High	High	5/20/2021	0.5	4.1	0.4	2.9
Tajikistan	Yes	High	High	5/20/2021	0.8	63.8	0.6	50.3
Tanzania	Yes5	Low	…	1/18/2021	0.2	138.6	0.2	109.6
Timor-Leste	No	Low	Low	3/19/2021	0	0	0	0
Togo	Yes5	Moderate	High	4/20/2021	0.5	26.6	0.4	23.9
Tonga	Yes5	High	…	1/18/2021	1.2	6.3	1.2	6.2
Tuvalu	No	High	…	6/18/2021				
Uganda	Yes5	Low	Low	5/20/2021	0.2	91.1	0.3	107
Uzbekistan	No	Low	Low	5/20/2021	0.4	257.3	0.4	217.5
Vanuatu	No	Moderate	Moderate	6/19/2021	0.7	6.2	0.7	6.1
Yemen, Rep.	Yes	…	…		0.9	211.5	0.6	137.7
Zambia	Yes5	High	High	7/19/2021	0.7	165.4	0.8	184

1Estimated debt-service payments owed to all official bilateral creditors as per the World Bank Debtor Reporting System (DRS) and International Debt Statistics definitions and classifications . Estimates are derived from monthly IDS projections based on end-2019 external public and publicly guaranteed debt outstanding and disbursed. Data for South Sudan, Micronesia, Tuvalu, Kiribati, and Marshall Islands are not available. GDP data based on Oct. 2020 WEO. The full IDS database is available here .

2Reflects published DSA ratings as of end-December 2020.

3Not covered under joint Bank-Fund Debt Sustainability Framework for Low-Income Countries.

4IDA countries as of FY 20, and Angola

5 Reflects if a country has requested participation in 2020 and 2021.

Source: World Bank 2021.

Table 14. List of IDA Eligible Countries

Afghanistan	Maldives 3
Bangladesh 4	Mali
Benin	Marshall Islands 3
Bhutan 3	Mauritania
Burkina Faso	Micronesia, FS 3
Burundi	Mozambique
C.A.R.	Myanmar 4
Cambodia 4	Nepal
Cameroon 2 & 4	Nicaragua 4
Cape Verde 2 & 3	Niger
Chad	Nigeria 2 & 4
Comoros 3	Pakistan 2 & 4
Congo, Democratic Republic of	Papua New Guinea 2 & 4
Congo, Republic of 2 & 4	Rwanda
Cote d'Ivoire 4	Samoa 3
Djibouti 3	Sao Tome and Pr. 3
Dominica 2 & 3	Senegal
Eritrea 1	Sierra Leone
Ethiopia	Solomon Islands 3
Fiji 2 & 3	Somalia
Gambia, The	South Sudan
Ghana 4	St Lucia 2 & 3
Grenada 2 & 3	St Vincent 2 & 3
Guinea	Sudan 1
Guinea-Bissau	Syrian Arab Republic1
Guyana 3	Tajikistan
Haiti	Tanzania
Honduras 4	Timor-Leste 2 & 3
Kenya 2 & 4	Togo
Kiribati 3	Tonga 3
Kosovo 4	Tuvalu 3
Kyrgyz Republic	Uganda
Lao, PDR 4	Uzbekistan 2 & 4
Lesotho 4	Vanuatu 3
Liberia	Yemen, Republic of
Madagascar	Zambia 4
Malawi	Zimbabwe 1 & 2

1 Inactive countries: no active IDA financing due to protracted non-accrual status.

2 Blend countries: IDA-eligible but also creditworthy for some IBRD borrowing.

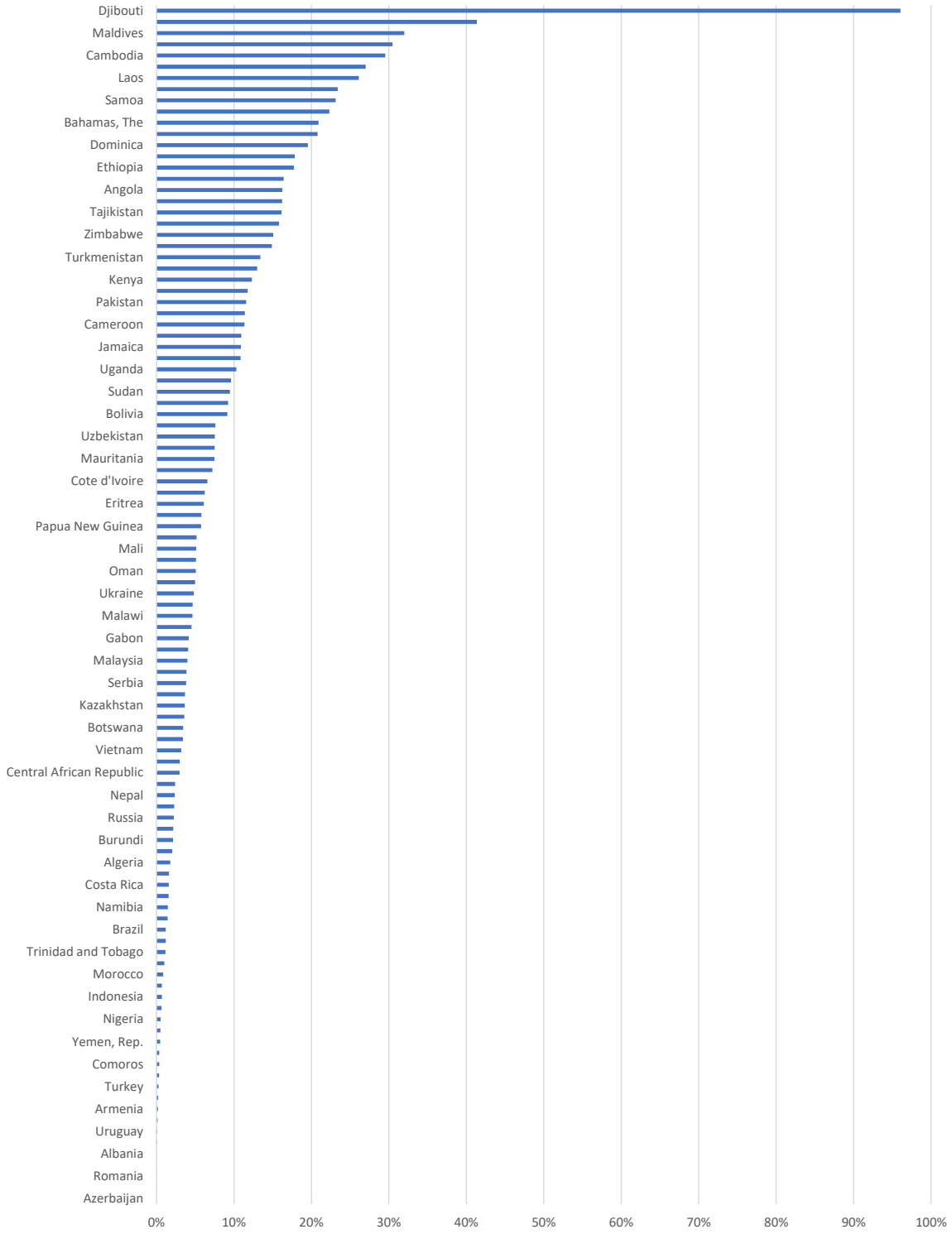
3 Borrowing on small economy terms.

4 Borrowing on blend credit terms.

74 IDA-eligible countries; 59 IDA-only; and 15 blend countries.

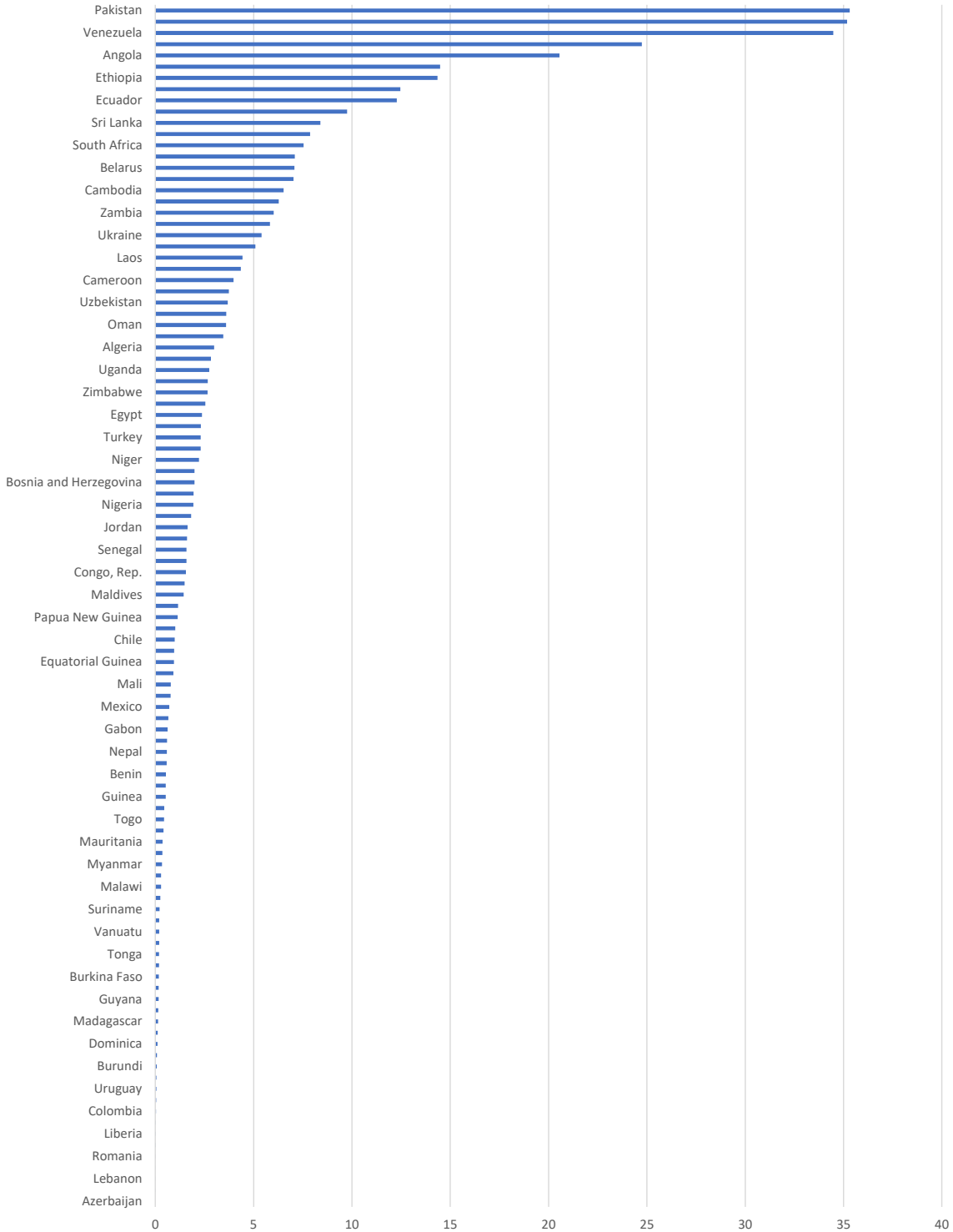
Source: World Bank n.d.

Table 15. Debt Owed to China, % of Borrower Country GDP



Source: Horn, Reinhart, and Trebesch 2019.

Table 16. Debt Owed to China, US$ Billion



Source: Horn, Reinhart, and Trebesch 2019.

Table 17. Paris Club Membership

Permanent Members	Ad-hoc Participants	Observers
Australia	Abu Dhabi	International Monetary Fund (IMF)
Austria	Argentina	World Bank
Belgium	People's Bank of China	Organisation for Economic Co-operation and Development (OECD)
Brazil	Kuwait	United Nations Conference on Trade and Development (UNCTAD)
Canada	Mexico	European Commission
Denmark	Morocco	African Development Bank
Finland	New Zealand	Asian Development Bank
France	Portugal	European Bank for Reconstruction and Development (EBRD)
Germany	South Africa	Inter-American Development Bank (IADB)
Ireland	Trinidad and Tobago	
Israel	Turkey	
Italy		
Japan		
Netherlands		
Norway		
Russia		
South Korea		
Spain		
Sweden		
Switzerland		
United Kingdom		
United States		

Source: Club de Paris n.d.

Table 18. G20 Membership

Permanent Members	Permanent Guest
Argentina	Spain
Australia	
Brazil	
Canada	
China	
France	
Germany	
Japan	
India	
Indonesia	
Italy	
Mexico	
Russia	
South Africa	
Saudi Arabia	
South Korea	
Turkey	
United Kingdom	
United States	
European Union	

Source: G20 n.d.

Variance Tests for Paris Club vs. Non-Paris Club Treatment, Various Indicators

Table 19. Means and Variance Test for GDP Growth, PC and Non-PC Treatment, T0 to T3

Two-sample t test with equal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	1108	308	0.034	0.047	-0.014	0.004	-3.2	0.002

Variance ratio test

Group	Obs	Mean	Std.Err.	Std.Dev.	[95%Conf.	Interval]
NonPC	1,108	0.034	0.002	0.07	0.029	0.038
PC	308	0.047	0.003	0.049	0.042	0.053
combined	1,416	0.037	0.002	0.066	0.033	0.04

ratio = sd(NonPC) / sd(PC) f = 2.0172
Ho: ratio = 1 degrees of freedom = 1107, 307
Ha: ratio < 1 Ha: ratio != 1 Ha: ratio > 1
Pr(F < f) = 1.0000 2*Pr(F > f) = 0.0000 Pr(F > f) = 0.0000

Two-sample t test with unequal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	1108	308	0.034	0.047	-0.014	0.004	-3.2	0.002

Table 20. Means and Variance Test for Debt to GDP, PC and Non-PC Treatment, T0 to T3

Two-sample t test with equal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	851	347	57.005	68.67	-11.665	2.783	-4.200	0.000

Variance ratio test

Group	Obs	Mean	Std.Err.	Std.Dev.	[95%Conf.	Interval]
NonPC	851	57.005	1.47	42.891	54.12	59.891
PC	347	68.67	2.446	45.569	63.858	73.481
combined	1,198	60.384	1.271	43.984	57.891	62.877

ratio = sd(NonPC) / sd(PC) f = 0.8859
Ho: ratio = 1 degrees of freedom = 850, 346
Ha: ratio < 1 Ha: ratio != 1 Ha: ratio > 1
Pr(F < f) = 0.0859 2*Pr(F < f) = 0.1718 Pr(F > f) = 0.9141

Two-sample t test with unequal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	851	347	57.005	68.67	-11.665	2.783	-4.200	0.000

Table 21. Means and Variance Test for Debt to GDP (% Change), PC and Non-PC Treatment, T0 to T3

Two-sample t test with equal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	626	255	0.436	-6.318	6.753	1.125	6.000	0.000

Variance ratio test

Group	Obs	Mean	Std.Err.	Std.Dev.	[95%Conf.	Interval]
NonPC	626	0.435	0.518	12.95	-0.581	1.452
PC	255	-6.318	1.224	19.538	-8.728	-3.908
combined	881	-1.519	0.521	15.449	-2.541	-0.498

ratio = sd(NonPC) / sd(PC) f = 0.4393
Ho: ratio = 1 degrees of freedom = 625, 254
Ha: ratio < 1 Ha: ratio != 1 Ha: ratio > 1
Pr(F < f) = 0.0000 2*Pr(F < f) = 0.0000 Pr(F > f) = 1.0000

Two-sample t test with unequal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	626	255	0.436	-6.318	6.753	1.125	6.000	0.000

Table 22. Means and Variance Test for External Debt Service, % GDP, PC and Non-PC Treatment, T0 to T3

Two-sample t test with equal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	902	435	0.022	0.019	0.002	0.002	1.55	0.118

Variance ratio test

Group	Obs	Mean	Std.Err.	Std.Dev.	[95%Conf.	Interval]
NonPC	902	0.021	0.001	0.026	0.02	0.023
PC	435	0.019	0.001	0.021	0.017	0.021
combined	1,337	0.021	0.001	0.024	0.019	0.022

ratio = sd(NonPC) / sd(PC) f = 1.6043
Ho: ratio = 1 degrees of freedom = 901, 434
Ha: ratio < 1 Ha: ratio != 1 Ha: ratio > 1
Pr(F < f) = 1.0000 2*Pr(F > f) = 0.0000 Pr(F > f) = 0.0000

Two-sample t test with unequal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	902	435	0.022	0.019	0.002	0.002	1.55	0.118

Table 23. Means and Variance Test for Change in External Debt Service, % GDP, PC and Non-PC Treatment, T0 to T3

Two-sample t test with equal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	234	109	0.002	-0.005	0.007	0.003	2.65	0.008

Variance ratio test

Group	Obs	Mean	Std.Err.	Std.Dev.	[95%Conf.	Interval]
NonPC	234	0.002	0.001	0.02	-0.001	0.004
PC	109	-0.005	0.002	0.023	-0.009	0
combined	343	0	0.001	0.021	-0.003	0.002

ratio = sd(NonPC) / sd(PC) f = 0.7068
Ho: ratio = 1 degrees of freedom = 233, 108
Ha: ratio < 1 Ha: ratio != 1 Ha: ratio > 1
Pr(F < f) = 0.0152 2*Pr(F < f) = 0.0304 Pr(F > f) = 0.9848

Two-sample t test with unequal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	234	109	0.002	-0.005	0.007	0.003	2.65	0.008

Table 24. Means and Variance Test for Current Account Balance, % GDP, PC and Non-PC Treatment, T0 to T3

Two-sample t test with equal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	1030	456	-0.038	-0.045	0.007	0.006	1.2	0.234

Variance ratio test

Group	Obs	Mean	Std.Err.	Std.Dev.	[95%Conf.	Interval]
NonPC	1,030	-0.038	0.003	0.096	-0.044	-0.032
PC	456	-0.045	0.006	0.121	-0.056	-0.034
combined	1,486	-0.04	0.003	0.104	-0.045	-0.035

ratio = sd(NonPC) / sd(PC) f = 0.6397
Ho: ratio = 1 degrees of freedom = 1029, 455
Ha: ratio < 1 Ha: ratio != 1 Ha: ratio > 1
Pr(F < f) = 0.0000 2*Pr(F < f) = 0.0000 Pr(F > f) = 1.0000

Two-sample t test with unequal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	1030	456	-0.038	-0.045	0.007	0.006	1.2	0.234

Table 25. Means and Variance Test for Cumulative Current Account Balance, % GDP, PC and Non-PC Treatment, T0 to T3

Two-sample t test with equal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	261	114	-0.149	-0.179	0.03	0.037	0.8	0.425

Variance ratio test

Group	Obs	Mean	Std.Err.	Std.Dev.	[95%Conf.	Interval]
NonPC	261	-0.15	0.02	0.317	-0.188	-0.111
PC	114	-0.18	0.035	0.374	-0.249	-0.11
combined	375	-0.159	0.017	0.335	-0.193	-0.125

ratio = sd(NonPC) / sd(PC) f = 0.7176

Ho: ratio = 1 degrees of freedom = 260, 113

Ha: ratio < 1 Ha: ratio != 1 Ha: ratio > 1

Pr(F < f) = 0.0161 2*Pr(F < f) = 0.0321 Pr(F > f) = 0.9839

Two-sample t test with unequal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	261	114	-0.149	-0.179	0.03	0.037	0.8	0.425

Table 26. Means and Variance Test for Change in Current Account Balance, % GDP, PC and Non-PC Treatment, T0 to T3

Two-sample t test with equal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	259	114	0.002	-0.009	0.011	0.013	0.85	0.396

Variance ratio test

Group	Obs	Mean	Std.Err.	Std.Dev.	[95%Conf.	Interval]
NonPC	259	0.001	0.007	0.112	-0.012	0.015
PC	114	-0.009	0.011	0.112	-0.03	0.011
combined	373	-0.002	0.006	0.112	-0.013	0.009

ratio = sd(NonPC) / sd(PC) f = 0.9992

Ho: ratio = 1 degrees of freedom = 258, 113

Ha: ratio < 1 Ha: ratio != 1 Ha: ratio > 1

Pr(F < f) = 0.4896 2*Pr(F < f) = 0.9792 Pr(F > f) = 0.5104

Two-sample t test with unequal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	259	114	0.002	-0.009	0.011	0.013	0.85	0.396

Table 27. Means and Variance Test for Primary Fiscal Balance, % GDP, PC and Non-PC Treatment, T0 to T3

Two-sample t test with equal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	911	396	-0.009	-0.029	0.02	0.014	1.45	0.144

Variance ratio test

Group	Obs	Mean	Std.Err.	Std.Dev.	[95%Conf.	Interval]
NonPC	911	-0.01	0.002	0.051	-0.013	-0.006
PC	396	-0.029	0.02	0.394	-0.068	0.01
combined	1,307	-0.016	0.006	0.221	-0.028	-0.004

ratio = sd(NonPC) / sd(PC) f = 0.0167

Ho: ratio = 1 degrees of freedom = 910, 395

Ha: ratio < 1 Ha: ratio != 1 Ha: ratio > 1

Pr(F < f) = 0.0000 2*Pr(F < f) = 0.0000 Pr(F > f) = 1.0000

Two-sample t test with unequal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	911	396	-0.009	-0.029	0.02	0.014	1.45	0.144

Table 28. Means and Variance Test for Cumulative Primary Fiscal Balance, % GDP, PC and Non-PC Treatment, T0 to T3

Two-sample t test with equal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	241	102	-0.036	-0.113	0.076	0.089	0.85	0.393

Variance ratio test

Group	Obs	Mean	Std.Err.	Std.Dev.	[95%Conf.	Interval]
NonPC	241	-0.037	0.011	0.167	-0.058	-0.016
PC	102	-0.113	0.135	1.366	-0.381	0.155
combined	343	-0.059	0.041	0.756	-0.14	0.021

ratio = sd(NonPC) / sd(PC) f = 0.0149

Ho: ratio = 1 degrees of freedom = 240, 101

Ha: ratio < 1 Ha: ratio != 1 Ha: ratio > 1

Pr(F < f) = 0.0000 2*Pr(F < f) = 0.0000 Pr(F > f) = 1.0000

Two-sample t test with unequal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	241	102	-0.036	-0.113	0.076	0.089	0.85	0.393

Table 29. Means and Variance Test for Change in Primary Fiscal Balance, % GDP, PC and Non-PC Treatment, T0 to T3

Two-sample t test with equal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	241	102	0.001	-0.005	0.006	0.007	0.95	0.337

Variance ratio test

Group	Obs	Mean	Std.Err.	Std.Dev.	[95%Conf.	Interval]
NonPC	241	0	0.004	0.055	-0.007	0.007
PC	102	-0.006	0.005	0.054	-0.016	0.005
combined	343	-0.001	0.003	0.055	-0.007	0.004

ratio = sd(NonPC) / sd(PC) f = 1.0580

Ho: ratio = 1 degrees of freedom = 240, 101

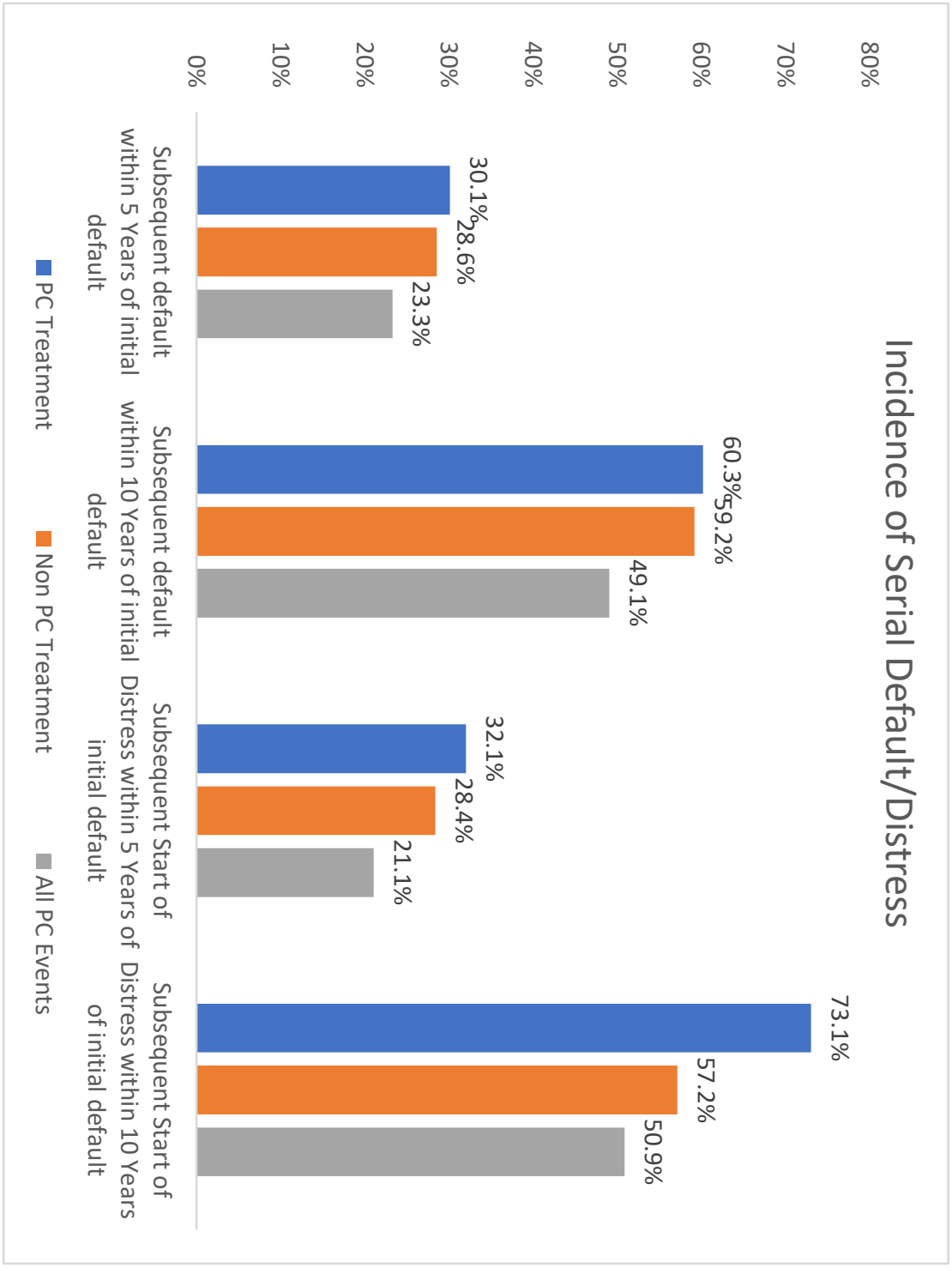
Ha: ratio < 1 Ha: ratio != 1 Ha: ratio > 1

Pr(F < f) = 0.6222 2*Pr(F > f) = 0.7555 Pr(F > f) = 0.3778

Two-sample t test with unequal variances

	NonPC Obs	PC Obs	NonPC Mean	PC Mean	dif	St Err	t value	p value
outcome by treatment	241	102	0.001	-0.005	0.006	0.007	0.95	0.337

Figure 43. Incidence of Serial Default/Distress



Source: Dielmann Default Data

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